# ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

## Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 17, No. 26. WEEKLY. NEW YORK, SATURDAY, FEBRUARY 21, 1891. $3 per annum. Single Copies, 10 Cents.


Copyright, 1891, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

### What Will be Done at Providence this Week.

No set programme of details will be issued until the delegates arrive at the convention. The main facts are as follows: The headquarters of the Association will be at the Narragansett Hotel, which occupies the block separating the Masonic Temple, where the meetings of the convention will be held, from Union Hall, where the exhibition will be given.

Present your credentials the first thing Tuesday morning and get your name on the roster.

The morning session on Wednesday, the 18th, will be designated memorial session and the first decennial celebration of electric lighting will be held. The following persons, representatives of the principal departments of electrical development, have been invited to participate in this celebration, as guests of the Association:

Telegraphy—Dr. Norvin Green.
Ocean Telegraphy—Cyrus W. Field.
Telephoning—Alexander Graham Bell.
Arc Lighting—Chas. F. Brush.
Incandescent Lighting—Thos. A. Edison.
Electric Street Railroad—Hon. Henry M. Whitney.
Electric Welding—Prof. Elihu Thomson.
Technical Education in Electrical Engineering—Gen. Francis A. Walker.
Steam Engineering for Dynamo Driving—Gardiner C. Sims.
Organization of the National Electric Light Association—Geo. Worthington, editor of the ELECTRICAL REVIEW.
Place of Electrical Invention and Development in History—Prof. J. Elfreth Watkins.

Wednesday evening the president's reception will be given at Spink's Assembly Rooms from 8 till 11 o'clock.

Thursday evening Mr. Eugene F. Phillips will give a house-warming at the American Electrical Works.

During the convention the following papers will be read:

How can the National Electrical Light Association best serve Central Station Interests? by C. R. Huntley.

Distribution of Steam from a Central Station; by F. H. Prentiss.

Distribution and Care of Alternating Currents; by T. Carpenter Smith.

Municipal Control of Electric Railroads; by M. W. Mead.

The Ferranti System; by C. B. Haskins.

Electric Lighting as Applied to Steam Railroads; by W. H. Markland.

The Electric Arc and its Use in Lighting; by Prof. Elihu Thomson.

Prof. Thomson writes as follows: "I shall endeavor to make the paper an outline of the characters of the arc, scientifically considered, the characters of dynamo machines which are useful for arc lighting, the desirable features in arc lamps and the difference in their workings."

These Providence companies have invited every one attending the convention to visit their establishments: Brown & Sharpe Manufacturing Company, American Screw Company, Gorham Manufacturing Company, Rhode Island Locomotive Works, New England Butt Company, Armington & Sims Engine Company, American Electrical Works.

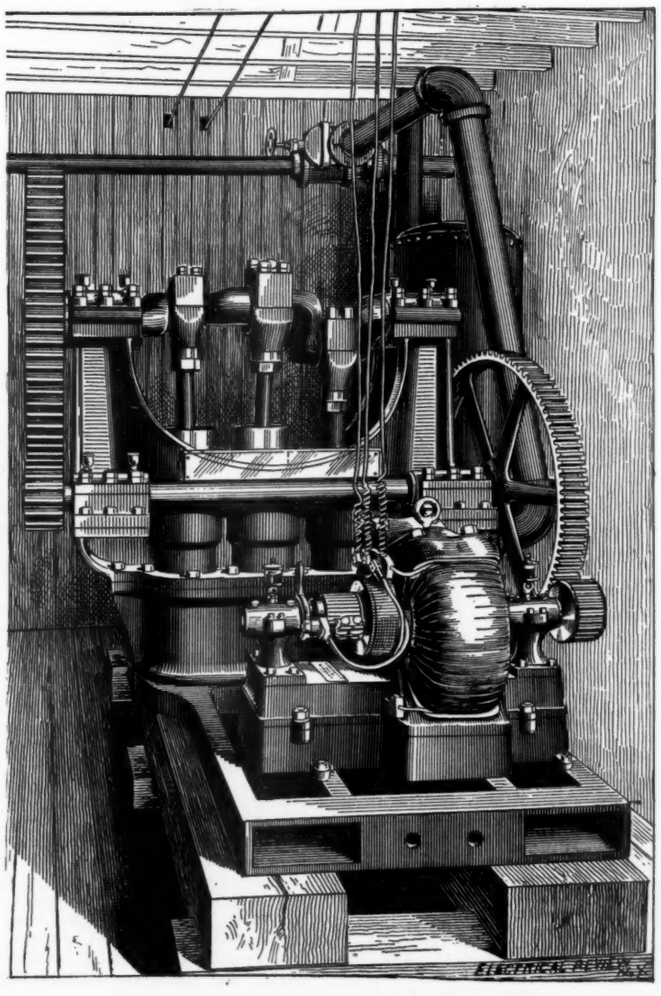
### A Cable Hand-Book.

A very neat and handsome pocket diary for the year 1891 has been issued by the Eastern Telegraph Company, of London, which is a connection of the Direct United States Cable Company. It contains 12 excellent maps of the countries to which its many cables run and which its land lines traverse. The continent of Africa is completely girdled by its cables. Cablegrams may be sent to 25 towns on the west coast, to a dozen on the south coast, and to all the cities of Northern Africa, of Egypt and of the country along the Red Sea. The book contains a calendar, and the maps are handy for reference. It is a revelation of the world-wide growth of the telegraph system. The bottom of the ocean seems to be paved with telegraph cables. Any one may talk with a commercial agent or explorer in almost any town on the African coast in half an hour, and the Shah of Persia may chat by cable with his brother sovereign, who is the Prince of Senegal.

### American Institute of Electrical Engineers.

The fifty-fourth meeting of the Institute will be held on Tuesday evening, February 24, at eight o'clock, at the rooms of the Institute, No. 12 West Thirty-first street. A paper will be read by Mr. Oscar T. Crosby, of Boston, entitled: "Data and Results of Experiments with Electric Traction at 120 Miles an Hour." A working model of an electric railway made by Thomas Davenport in 1837, will also be exhibited in actual operation, and some interesting facts regarding its history will be given by Mr. Franklin Leonard Pope. If time permits, the reports of the standard wiring table committee and that of the committee on amendment of the patent law will be taken up for consideration.

The date of this meeting has been changed from the usual third Tuesday of the month, by vote of council, in order to avoid conflicting with the Electric Light Convention at Providence. A special invitation is extended to members of the National Electric Light Association to attend this meeting. The council will meet in the secretary's office at 7 P. M.



"C. & C." ELECTRIC MOTOR OPERATING HYDRAULIC PUMP.

### "C. & C." Motor Applied to a Hydraulic Pump.

Among the more important applications of electric power is that of pumping water, chiefly for the purpose of operating hydraulic elevators. To realize some of the great economic advantages of this application it is only necessary to reflect on the large number of buildings using hydraulic elevators, and depending on steam pumps, operated by the heating plant, for their water supply. Now, for about six months, viz., from May till October, artificial heat is not, as a rule, required, but the steam plant must be kept in operation to work the pumps. If, on the other hand, the pumps are worked by electric power derived from a central station, the whole heating plant may be shut down during the Summer months, thereby greatly reducing running expenses, insurance rates and discomfort. The only attention required by an electric motor is to start and stop it when desired, and look at it two or three times a day. Any man of ordinary intelligence can learn in half an hour all that is necessary to operate a properly constructed motor.

The illustration shows a motor recently installed by the "C. & C." Electric Motor Company, driving a pump which supplies water for three elevators.

The motor is of 10 horse-power capacity, built to run at a constant speed of 1,200 revolutions per minute with 500 volts, and is supplied from a central power station.

The pump is geared to the motor through noiseless pinions and is of the triplex pattern, making 50 strokes per minute and pumps five gallons per stroke, equal to 250 gallons per minute, which is pumped 80 feet.

This is equivalent to five and a fraction horse-power and the motor develops eight horse-power, giving an efficiency of 62.5 per cent. for the whole plant. An automatic device is used whereby the power is cut off when the tank is filled, and started again when the water level falls.

These installations are equally applicable to roof or pressure tanks, the stopping and starting in the latter case being controlled by the pressure.

Another application of electric pumping is in the drainage of mines, the great flexibility of electric power transmission making it particularly adapted to mining work.

In many silver and copper mining regions the cost of coal is so high that an enormous saving can be effected by utilizing water powers miles away through electric transmission. Even where there is no water power, the advantage of having all the power required generated at one place on the surface and transmitted through wires is easily seen.

---

Messrs. Chadbourne, Hazelton & Company have recently closed a contract with the Athens Street Railway Company, Athens, Ga., for the entire equipment of this line. The new slow speed, direct gear Wenstrom motor will be used. The station will be equipped with the Wenstrom apparatus throughout. One 50,000 watt generator will furnish the power for the five cars. Standard Brill trucks will be used, and the entire equipment will be first-class in every respect. The road is about five miles long, and runs from Macon to Athens, Ga.

## Street Railway Tracks.

A NEW INVENTION HIGHLY RECOMMENDED.

TO THE EDITOR OF ELECTRICAL REVIEW:

The owner of a street railroad operated by electricity recently requested me to find him a track that would not break down at the joints.

His own road has been constructed in the most thorough style, with heavy girder rail, improved chairs and rail fastenings; and, after little more than a year's service, his track was completely knocked out at its joints.

On investigation I find this is not at all a singular experience. That, on the contrary, probably every track in the country, over which electrical motors run, after one or two years' use, discloses approximately the same condition.

Nor is the trouble confined to the track of the old and well-known systems, a great showing of "low joints" being already visible in the track of an entirely new system, laid in October last, in a city in this State.

The slightest investigation of the street railway field reveals a bewildering number of new tracks. Apparently "everybody" has invented a street railway track during the past two years.

This seem to be evidence that the track already in the field does not come up to the present requirements, and it also evidences demand for something better, and it would seem to indicate a belief that a fortune awaits the advent of a really good street railway track.

Many of these new tracks have been invented in recognition of the special problems that obtain in street railways, by reason of the street pavements and the vehicular traffic of the streets, and the box form of rail, will, no doubt, in the near future, take the place of the present girder construction; a sufficient reason, therefore, being its freedom from torsional strain and its perfect support for the pavements.

Such qualities, however, do not approach in importance the supreme requirements of a good joint. The rail connections must be very good to be buried under the pavement and maintain themselves always without the assistance of the trackman's adjustments.

Here is the one vital point; and it is not too much to say that this problem of good joints for the track must be settled before any complete measure of satisfaction can be obtained for electricity as a motive power.

As all longtitudinal fastenings seem inadequate to the proper connection of the rails of a street railway, I have interested myself in the other principle of their connection; namely, by a lap-jointing system, with a view to determine if some application of that principle would not produce the desired result.

Certainly a sufficiently perfect application of that principle would eliminate weakness at the joints; and I am, therefore, convinced that the solution of the "joint problem" is only to be found in such an under and over lapping of rails as practically shall produce a continuous track.

I have given considerable study to a system on these lines that is entirely new. It seems to have had all its features worked out with that attention to minor and practical details which shows its inventor to be a railroad engineer familiar in actual practice with the working of street railway track.

I shall, therefore, not hesitate to recommend this system unqualifiedly, and prior to any demonstration of its merit by actual use.

I think the duplex lap-joint track (so it is called) is the best system of street railway track I have ever seen, in every respect, and I congratulate its inventor upon his work.

Not the least of its merits, electrically considered, is its practical continuity, which, in my judgment, is ample for a good transmission of the return current without the assistance of wiring.

If one of the great electrical companies should realize its direct interest in obtaining a perfect street railway track, in connection with its railway department, the immense superiority of the lap-joint system would, I believe, give the company endowed with it a great advantage over its competitors.

E. T. GILLILAND.

New York, February 10, 1891.

## In Favor of a Tunnel.

All of the electrical construction companies are deeply interested in the present rapid transit problem in New York, and all of them are prepared to submit plans and specifications for electric traction on elevated, arcade or tunnel roads. After conversation with representatives of the leading electrical companies, a reporter of *The Journal of Finance* has found that the tunnel project is the one most generally favored. By means of the Beach, or, as it is better known, the Greathead shield, tunnels could be driven under any street or avenue in the city without interfering with traffic on the surface, or tearing up the pavements in any way. There is at present a tunnel two blocks long under lower Broadway. Few New Yorkers know that it is there, and fewer still know how or when it was constructed, as even when it was built, there were no evidences on the surface that the work was going on. This tunnel extends from the corner of Mail street to Warren street, and then turns and runs nearly half a block down Warren street. The work was done during the lively agitation of 1869, which preceded the building of the present elevated railroad system. The tunnel was built by Mr. A. E. Beach at his own expense to prove that such a tunnel could be constructed, and to carry out his plan he invented the shield now so well known as the Greathead. This shield was successfully used in constructing the underground railways of London, the tunnel under the St. Clair river from Port Huron, Mich., to Sarnia, on the Canadian side, and is now being used in the tunnel under the Hudson river. The tunnel under Broadway is nine feet four inches in diameter, and is lined with cast iron segments. The tunnel still remains to prove that underground rapid transit is feasible for New York. The entrance to the big circular vault is through the sub-cellar of Rogers, Peet & Company's store, and although no care has been taken to ventilate the tunnel, or to keep it in repair since it was built, 20 years ago, the air is still breathable, and it is as dry as a well-kept cellar. Of course, it is far below the sewers, gas pipes, steam pipes and other pipes that form New York's underground nuisance.

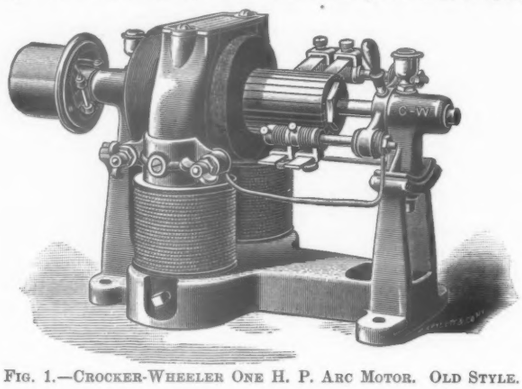


FIG. 1.—CROCKER-WHEELER ONE H. P. ARC MOTOR. OLD STYLE.

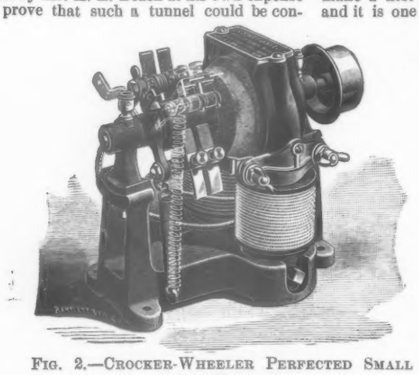


FIG. 2.—CROCKER-WHEELER PERFECTED SMALL ARC MOTOR.

## A Theatrical Manager's Phonograph.

While two friends were chatting with Manager Burnham, in his cosey office in the Star Theatre, one night, recently, Comedian Billy Crane's voice was heard suddenly at the manager's elbow, says the New York *Sun*. The visitors looked startled. They had seen the actor upon the stage in "The Senator," only a few moments before, and knew that he was still on the stage. "Gentlemen," said the voice, "I will now sing you a comic song."

The comic song came along, unmistakably by Crane. It was the song he made a hit in over 30 years ago, when he was end man in the minstrels.

"Well, this is a surprise," exclaimed one of the manager's friends, and he rose and walked behind the manager's chair. A big sheet-iron funnel, held up by an iron stand, was concealed behind him. Crane's voice came from the big funnel.

"I have more fun with that phonograph," Manager Burnham said, "than I've had with any one thing before in my life. It's run by an electric motor, and I can start and stop it at will without warning."

The phonograph is very ingeniously arranged, looking more like a typewriter than anything else, and what's more, it's better than any phonograph in town because there is no other that can turn out the work of such a variety of well-known people.

Crane is only one of many friends of the manager who have talked into it. Poets have read to it original poetry, popular singers have warbled into it, actors have spouted to it, a whole orchestra has played into it, and it has had a variety of other novel and diverting experiences. Everything that these entertainers have done is preserved upon little cylinders of wax, and Manager Burnham can have them all repeated any time. He has enough cylinders already to make a first-class two hour entertainment, and it is one of his methods of amusement to invite a group of intimates into his office, and set the phonograph off. He generally sets it going without warning, and has a heap of fun.

## BOOK NOTICES.

The new catalogue of the University of Pennsylvania is out. A good course in electrical engineering is laid down.

"Annual Report of the Lighthouse Board" for 1890 has been received.

"Comics from Scribner's Magazine" is a charmingly witty and artistic pamphlet, containing drawings and jests which have appeared from time to time in the magazine. The excruciatingly funny pen-and-inks of A. B. Frost, the graceful and artistic work of Charles Howard Johnson, F. S. Church, C. D. Gibson, F. G. Attwood and A. Brennan, and the characteristic work of "Chip" and Howarth are included in the collection. "Comics" will make your mother-in-law laugh.

The pocket hand-book recently issued by the Standard Underground Cable Company, of Pittsburgh, is even better than the one of last year. It is of a high order of technical excellence. The products of the company are minutely described, a feature of great value to engineers using them. Many valuable hints, especially regarding cable laying, are given. Interesting and valuable tables appear in profusion. Several leaves of coordinate paper are bound in with the printed matter. The illustrations are profuse and good. The new hand-book will be highly prized by electrical engineers.

## Crocker-Wheeler Constant Current Motors.

The arc motor is difficult to make so as to run enduringly, and while the points to be observed in setting up and caring for it are the same, the mode of connecting it to the circuit and its manner of operation thereon electrically are opposite to those covered by the instructions given for other motors.

The Crocker-Wheeler Electric Motor Company, of this city, have experimented upon every possible form of governor for arc motors, and as a result now offer a complete series of machines from one-eighth to five horse-power which have been found to govern promptly without sparking, and to be thoroughly satisfactory. They furnish them wound for any circuit, keeping them in stock for 6.5, 9.5 and 18 amperes. Sizes above and including one-half horse-power have automatic centrifugal speed governors, and the sizes one-eighth, one-sixth and one-quarter horse-power have regulators to be moved by hand or treadle. The larger sizes can be provided with this form of regulator when ordered. The hand regulator controls the power and speed of the machines, from full power to zero, and at zero automatically cuts the motor out of circuit, thereby saving the current. This regulator has a spring attached which gives a tendency toward zero, so that if the motor is neglected or the regulator not held in the power-giving position by the treadle, the motor is stopped and cut out of circuit and the current is saved. In starting up, the first motion of the regulator restores the motor to circuit and then gradually increases its power. The motors with hand regulators are suitable for all kinds of work requiring variations of speed, such as driving sewing machines.

The automatically regulated arc motors are provided with an effective centrifugal governor similar to that of a steam engine. Its construction is extremely solid, the governor being directly upon the main shaft of the motor, which is extended in its full diameter to carry it. The tension of the governor spring is controlled by a heavy nut upon the extremity of the shaft working on a fine thread, by which the nicest adjustments of tension are attainable, and the motor may be set to govern at any speed. The governor motors are suitable for all kinds of work which require steady speed. The company is prepared to deliver all sizes of arc motors on short notice, keeping most of them, especially the smaller ones, in stock.

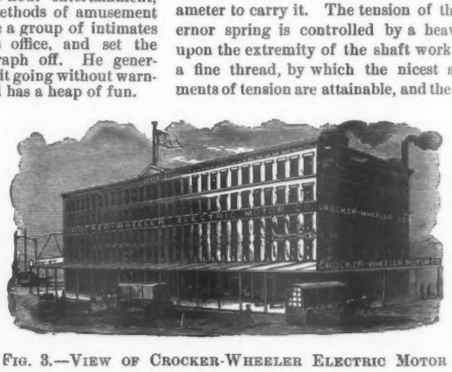


FIG. 3.—VIEW OF CROCKER-WHEELER ELECTRIC MOTOR COMPANY'S FACTORY.

These motors are already in use for running almost every conceivable variety of machinery, instruments, etc., differing as widely as elevators, organs, pumps, fans, dental drills, mining machinery, etc. For these purposes they are usually connected in some simple way by the ordinary mechanical means such as belting or gearing.

In addition to these common applications, the company named is prepared to undertake any special work in fitting these motors to new devices of all kinds. As an instance, we may mention the recent remodeling for the United States government of a Gatling gun, illustrated and described in the ELECTRICAL REVIEW, so as to be operated automatically by one of these perfected motors, an achievement which has been endorsed by many officials. The company gives particular attention to this department of special applications, and have secured for it a variety of talent with perfect facilities for good work.

A view of the Crocker-Wheeler factory is shown in Fig. 3. The building is equipped with the latest and most expensive machine tools and every facility is given to the large corps of trained employés for turning out the best possible work.

### The Patent Commissioner's Report.

The report of the Commissioner of Patents, for the year 1890, which has just been sent to Congress, shows an increase over the previous year of 473 in the number of applications, 2,134 in the number of patents issued, $58,644 in the amount of money received, and a surplus of $241,094.

The commissioner recommends some needed changes in the patent laws, and makes important suggestions for the improvement of the system. A few pertinent paragraphs should be noted:

"The first need of the Patent Office is additional room. The time will soon arrive when it will be impossible to discharge the functions of this bureau, unless some provision is made to afford relief for its overcrowded condition."

"The inventors of the country cannot understand why their money is taken, while adequate facilities are denied."

"I regard it nothing less than a public calamity that the office was several years ago compelled to suspend the reception of models for want of space in which to store and exhibit them. A public gallery containing specimens of all the inventions of the past ten years would furnish an exhibition of industrial growth of marvelous interest and value, and would be of vast assistance to inventors and examiners. I hope the time will come when models will again be required with all applications, and that an effort will be put forth to obtain specimens of the more important inventions which have been patented during the intervening period."

"It is in contemplation to celebrate the beginning of the second century of the patent system, on the 8th of April and the two succeeding days. The movement in the direction of such a celebration originated outside of official circles, and had its origin in the recognition of the influence, both beneficient and marvelous, which the patent system has exerted. The century just ending has seen more of material progress than many preceding centuries had witnessed. During the same period of 100 years, the American patent system had been in being, and had stimulated and protected inventions and inventors. It was impossible to overlook the coincidence or to disregard the lesson thereby suggested. It was impossible that the vast human interest which invests everything pertaining to the Patent Office should not obtain expression, and it would have excited surprise if the opportunity afforded had not been seized upon. There is every reason to expect that the celebration will be worthy of the occasion and of the transcendent importance to the American people of their patent system."

The following table, prepared by the Patent Office, shows the number of patents issued, during the year 1890, to citizens of the different States, with the ratio of such patents to the population:

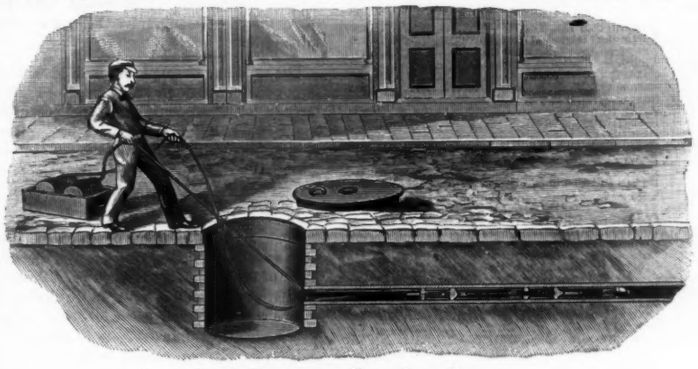
| | One patent to every | | One patent to every |
|---|---|---|---|
| Alabama | 14,689 | Nebraska | 4706 |
| Arkansas | 11,875 | Nevada | 3813 |
| California | 1887 | New Hampshire | 2189 |
| Colorado | 2240 | New Jersey | 1299 |
| Connecticut | 796 | New Mexico | 9599 |
| Delaware | 3303 | New York | 1308 |
| Dist. of Columbia | 980 | North Carolina | 21,864 |
| Florida | 7674 | North Dakota | 4567 |
| Georgia | 11,135 | Ohio | 2084 |
| Idaho | 7032 | Oklahoma | 15,458 |
| Illinois | 1778 | Oregon | 3826 |
| Indiana | 3272 | Pennsylvania | 1990 |
| Iowa | 4375 | Rhode Island | 1235 |
| Kansas | 4054 | South Carolina | 15,348 |
| Kentucky | 7375 | South Dakota | 5573 |
| Louisiana | 8164 | Tennessee | 9819 |
| Maine | 3443 | Texas | 7258 |
| Maryland | 3509 | Utah | 6930 |
| Massachusetts | 1068 | Vermont | 3291 |
| Michigan | 2136 | Virginia | 9355 |
| Minnesota | 3434 | Washington | 5459 |
| Mississippi | 23,147 | West Virginia | 8029 |
| Missouri | 3311 | Wisconsin | 2990 |
| Montana | 2493 | Wyoming | 7588 |

### A Popular Electric Railway.

The electric railway to Charlotte is fast becoming one of the most popular routes to the pleasure resorts on the lake, and considering the short length of time it has been in existence, its success has been phenomenal. During 1890, 470,000 passengers were carried, and of that number over 20,000 persons, including employés of the road, were carried free of charge. The electric cars on that road, from January 1, 1890, to January 1, 1891, traveled a grand total of 197,342 miles, or more than seven times the distance round the globe! The cars now run from the four corners to Ontario beach, and the prospects for a successful season next year are bright. In this connection it may be of interest to state that a car of the Rochester Street Railway Company travels on the average 125 miles per day.—*Rochester, N. Y., Express.*

### Cope's Device for Laying Pilot Lines in Conduits.

An invention to enable the operator to work above ground, if desired, and lay the pilot or lead line through electrical conduits quickly and cheaply, and avoid the necessity of blowing out gases, has been put upon the market by the Cope Electrical Pilot Line Company, 6 and 8 North Sixth street, Philadelphia. The device is illustrated herewith. By pulling alternately on the two cords

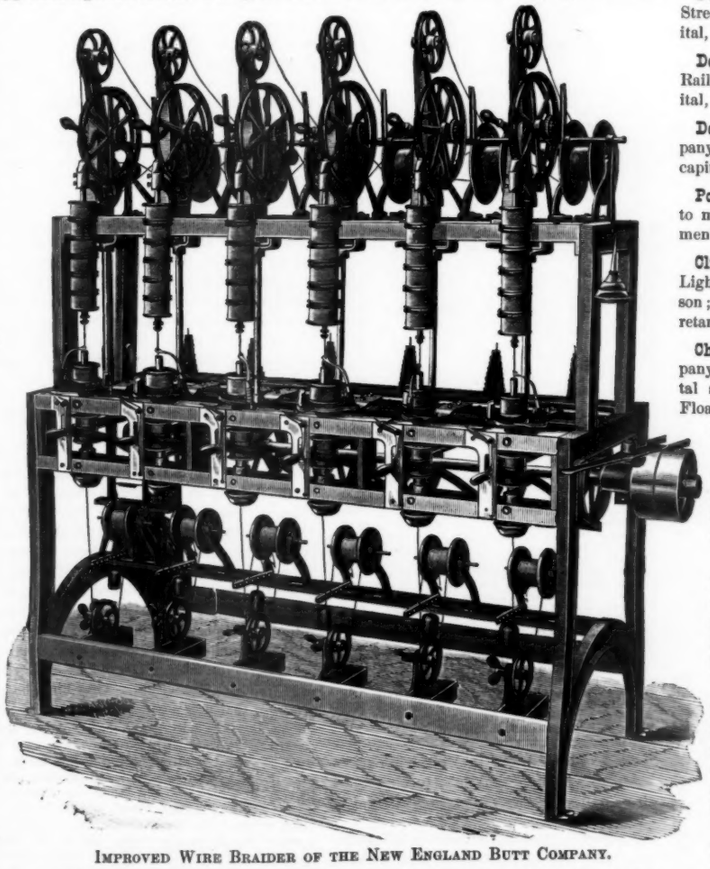


COPE'S ELECTRICAL PILOT LINE DEVICE.

shown, gripping rollers are caused to clamp the device to the inside of the conduit. At the same time the release of one cord causes one pair of gripping rollers to advance a short distance. By repeating this operation the pilot quickly makes its way through the conduit. It is then an easy matter to attach a heavier line and then the cable.

Two operators can put the pilot through a 500 foot conduit in less than 10 minutes. The machines have run ducts 900 feet long in 20 minutes.

The machines are pliable and will take curves of eight feet radius. For square ducts larger rollers are used and the machine is placed diagonally in the ducts. Should the duct be permanently obstructed, the machine can be thrown out of gear and withdrawn.



IMPROVED WIRE BRAIDER OF THE NEW ENGLAND BUTT COMPANY.

### Wire Covering Machinery.

We take pleasure in presenting to our readers this week a new machine for covering the finer numbers of electrical wires with silk or cotton. The machine is the product of the New England Butt Company, Providence, R. I., who have given so much energy and thought as well as incurring great expense in developing this class of machinery. The machine is a six spindle flyer winder, embracing some new and ingenious features, all of which have been secured by United States and foreign patents. The principle and construction of the machine securing the greatest maximum of speed with perfect work, the finest silk or cotton being laid on uniformly and with the least possible fraction of insulation. The head and winding point are the principal features which have fine adjustment for tension and for the different sizes of wires. The spool being on the spindle permits of high speed.

A novel feature is the reserve supply of full spools of silk or cotton to take the place of empty spools as they run out, the change from an empty spool to a full one being made without cutting the wire. A simple and quick arrangement is provided for changing the speed of take up wheel, and also for turning back to mend or splice a broken wire. The covered wire is wound onto a reel at the back of the machine, on which it is laid uniformly by a traverse motion. Each spindle is independent, so that different sizes of wires can be covered at the same time, and each has its own stop motion which operates to stop the machine when a thread breaks or a spool runs out. A large range of gears for variations of speed are provided.

This machine has attracted considerable attention already, orders having been received from England and Spain which are being executed. Further details as to the operation and construction of this machine will be furnished by the company on application.

**Portland, Me.**—Electric Clipper Company; capital, $9,500.

**Clinton, Ia.**—State Electric Company; capital, $300,000.

**Denver, Col.**—Electrical Construction Company; capital, $100,000.

**Clinton, Ia.**—Baldwin Electric Railway Company; capital, $100,000.

**Portland, Me.**—Builders' Insulating Tube Company; capital, $100,000.

**Richmond, Va.**—Johnston Safe Automatic Electric Company; capital, $50,000.

**Chicago, Ill.**—Northwestern Electrical Specialty Company; capital, $25,000.

**Wheaton, Ill.** — Wheaton Electric Light and Water Company; capital, $20,000.

**Osage, Ia.**—Osage Electric Light, Heat and Power Company; capital, $15,000.

**Lampasas, Tex.**—Lampasas Springs Electric Light and Power Company; capital, $20,000.

**Leadville, Col.**—Leadville and Evergreen Lakes Electric Railway Company; capital, $200,000.

**Fulton, Ill.**—Fulton and East Clinton Street Railway and Power Company; capital, $20,000.

**Dennison, O.**—Twin City Electric Street Railway, Light and Power Company; capital, $25,000.

**Denver, Col.**—The United Electric Company, to manufacture electrical devices; capital, $10,000,000.

**Portland, Me.**—The Telecone Company, to manufacture electrical signaling instruments; capital, $120,000.

**Clifton Forge, Va.**—Clifton Forge Electric Light Company. President, G. K. Anderson; vice-president, James A. Frazier; secretary and treasurer, J. Gardner Woodward.

**Chicago, Ill.**—Montrose Electric Company, to furnish light, power and heat; capital stock, $100,000. Incorporators: A. H. Floaten, H. H. Williams, A. A. Adair and others.

**Wellwood, N. J.**—Wellwood Electric Company, incorporated to construct, maintain and operate works for furnishing electric lights, heat and power; capital stock, $40,000.

**Brooklyn, N. Y.**—The Commercial Electric Company, Limited, to supply electric light and power; capital stock, $5,000. Incorporators, H. Carlton Radford, Jeremiah P. Robinson, Frank P. Sturges and Eliot Norton.

**Chicago, Ill.** — Carpenter Electric Company, to manufacture and sell electric machines, storage batteries, motors, dynamos and electrical appliances; capital $10,000,000; incorporators, H. H. Carpenter, H. F. Kent and Samuel D. King.

**East St. Louis, Ill.**—Adams' Electric Railway Company, to acquire and dispose of patents relating to electric railways and their equipments, to manufacture electric motors, cars, etc.; capital, $5,000,000. Incorporators, Edward V. Ringo, Augustine E. McBee and E. A. Engler.

**La Grange, Ky.**—La Grange Electric Light and Power Company; capital stock, $15,000. Incorporators, I. T. Risley, president; D. C. McDowell, secretary; John R. Adams, treasurer, and Wm. Pryor, I. T. Risley, D. H. French, J. W. Selph and J. W. Russell, forming the board of directors.

ELECTRICAL REVIEW

Published at 13 Park Row,

P. O. Box 3329. NEW YORK.

EDITORS:

GEO. WORTHINGTON. CHAS. W. PRICE.

ASSOCIATE EDITORS:

ROBT. H. READ. STEPHEN L. COLES.

BUSINESS STAFF:

GEO. WORTHINGTON, *President.* CHAS. W. PRICE, *Secretary.*

ROBT. H. READ, *Manager Patent Bureau.*

H. T. RICHARDS, *Mgr. Advertising Department.*

REGISTERED CABLE ADDRESS:

"ELECTVIEW," NEW YORK.

"1546 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:

W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:

GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:

D. B. DEAN, 163 Randolph Street.

EUROPEAN OFFICE:

CHARLES FFRENCH, Editor for Europe.

HOTEL VICTORIA,

Northumberland Ave., Charing Cross, London, W. C.

Cable Address: - - "Electview," London.

Telegraphic Address: Ffrench, "Victoriola," London.

SUBSCRIPTION TO THE ELECTRICAL REVIEW.

*One Year, United States and Canada, - $3.00*

*One Year, Foreign Countries, - - 5.00*

*Single Copy, - - - - .10*

## ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, FEB. 21, 1891.

## CONTENTS.

| | PAGE. |
|---|---|
| What Will be Done at Providence this Week | 307 |
| A Cable Hand-Book | 307 |
| American Institute of Electrical Engineers | 307 |
| "C & C." Motor Applied to a Hydraulic Pump | 307 |
| Street Railway Tracks | 308 |
| In Favor of a Tunnel | 308 |
| A Theatrical Manager's Phonograph | 308 |
| Book Notices | 308 |
| Crocker-Wheeler Constant Current Motors | 308 |
| The Patent Commissioner's Report | 309 |
| A Popular Electric Railway | 309 |
| Cope's Device for Laying Pilot Lines in Conduits | 309 |
| Wire Covering Machinery | 309 |
| New Corporations | 309 |
| More About Telephone Protectors | 310 |
| Keep Up with the Procession | 310 |
| A Sermon with a False Text | 310 |
| The Electric Lighting Plant at Hyde Park, Mass. | 310 |
| Correspondence: | |
| Our Washington Letter | 311 |
| Our London Letter | 311 |
| Our St. Louis Letter | 311 |
| Our Albany Letter | 311 |
| An Important Railway Contract | 311 |
| Brooklyn Institute | 311 |
| Financial | 311 |
| Telephonic News | 312 |
| Personal | 312 |
| Villard Denies It | 312 |
| Modern Uses of Electricity | 312 |
| Williams Switchboards | 312 |
| A Novel Multiple Telephone Switchboard | 313 |
| Laying Electric Cables | 313 |
| Telegraphic | 313 |
| New York Electric Club | 313 |
| Electric Power | 314 |
| Hunt's Circuit Breaker | 314 |
| Auburn City Railway Company, Auburn, N.Y. | 314 |
| Rapid Transit | 314 |
| The Faithful Phonograph | 314 |
| Our Minneapolis Letter | 314 |
| An Electrical House Warming | 314 |
| Literary | 314 |
| McCreary's Thermo Cut-Out | 314 |
| Our Seattle Letter | 314 |
| Mechanical Aids to Electric Lighting | 315 |
| Honoring Mr. Hine | 315 |
| Electric Light News | 315 |
| Foreign Patent Sharks | 316 |
| Change of Ownership | 316 |
| Sad Result of Mixing Telegrams | 316 |
| Electricity to Stop Runaway Horses | 316 |
| Mayor and President | 316 |
| Poles in New York | 316 |
| New Offices of a Big Wire Company | 316 |
| Properties of Solenoids | 317 |
| The Patent Celebration | 317 |
| More Appeals | 317 |
| Kindred Interests | 318 |
| The Crosby Batteries | 318 |
| Electrical Patents | xv |

## INDEX OF ADVERTISERS.

COVER PAGES.

| | PAGE. |
|---|---|
| Ansonia Brass & Copper Co | xxviii |
| Armington & Sims | xxviii |
| Bishop Gutta Percha Co | xxviii |
| Bridgeport Brass Co | xxviii |
| Bruah Electric Co | xxviii |
| Davis, Charles H., Electrical Engineer | xxviii |
| Day's Kerite Insulated Wires | xxviii |
| Eastern Electric Cable Co | xxviii |
| Hampson & Co., E. P. | xxviii |
| Jewell Belting Co | xxviii |
| Moore, Alfred F | xxviii |
| Okonite Co | ii & xxviii |
| Simplex Electrical Co | xxviii |
| Standard Underground Cable Co | xxviii |
| Tucker Electrical Construction Co | xxviii |

INSIDE PAGES.

| | |
|---|---|
| Accumulator Co., The | xxvi |
| Alexander, Barney & Chapin | x ii |
| American Bell Telephone Co | xvii |
| American Electrical Works | xvi |
| Baker & Co | xxiv |
| Barnes Co., W. F. & John | xix |
| Baxter, H. E. & C | xxv |
| Berlin Iron Bridge Co | xiii |
| Bernstein Electric Co | xiii |
| Bogart, A. L | xv |
| Brownlee & Co | xxi |
| Buckeye Engine Co | xix |
| Burton Electric Co | xix |
| Butler Hard Rubber Co | x |
| Cary Alanson | ix |
| "C. & C." Electric Motor Co | xvi |
| Central Electric Co | xii |
| Chadbourne, Hazelton & Co | xxiv |
| Chalmers-Spence Co | vii |
| Consolidated Electric Storage Co., The | xix |
| Crocker-Wheeler Motor Co | xxi |
| Crosby Electric Co | xiv |
| Davidson Steam Pump Co | vii |
| Detroit Electrical Works | iii |
| Dixon Crucible Co | xvii |
| Dwight Slate Machine Co | xxi |
| Edison General Electric Co | viii |
| Edson, Jarvis B | xv |
| Electric Gas Lighting Co | ix |
| Electrical Commission | xv |
| Electrical Supply Co | xxiv |
| Elektron Mfg. Co | xix |
| Empire China Works | xxi |
| Empire City Electric Co | xvii |
| Equitable Engineering and Construction Co. | xv |
| Eureka Tempered Copper Co | xxiv |
| Evans Friction Cone Co | xvii |
| Faraday Carbon Co | xxv |
| Field Engineering Co | xix |
| Fletcher & Fletcher Electric Co | xv |
| Foote Regulator Co., T. M | xxii |
| Fort Wayne Electric Co | xxvi |
| Garvin Machine Co | xxiii |
| Gate City Electric Co | xxii |
| Gethins Electrical Mfg. Co | xiii |
| Gordon & Co., W. H | xvi |
| Greeley & Co., The E. S | xii & xxi |
| Haasenstein & Vogeler | xv |
| Harris Oil Co | xvi |
| Heine Safety Boiler Co | xix |
| Holmes, Booth & Haydens | xxii |
| Holtzer-Cabot Electric Co | xii |
| Hulbert Fence and Wire Co | xxi |
| Independent Bung Co | xxii |
| India Rubber Comb Co | iii |
| Interior Conduit and Insulation Co | xxi |
| Kulp, D. H | xxiii |
| Lane & Bodley Co | xxv |
| Law Telephone Co | xv |
| Lecianche Battery Co | xvi |
| Leffel & Co., James | xxv |
| Lehigh Valley Creosoting Co | xxiii |
| Maguire, F. Z | xv |
| Marshall, Wm | xxiii |
| McCreary Electrical Specialty Co | xxiv |
| Nassau Electrical Co | xxii |
| National Carbon Co | xiii |
| National Electrical Mfg. Co | xxii |
| National Pipe Bending Co | x |
| New England Butt Co | xii |
| New York Belting and Packing Co | xxv |
| Noye Mfg. Co., John T | xii |
| Otis Bros. & Co | xix |
| Ostrander & Co., W. R | xxi |
| Paiste, H. T | xv |
| Parker-Russell Mining and Manufacturing Co. | xxv |
| Phœnix Glass Co | xvi |
| Phosphor-Bronze Smelting Co., Ltd | xvii |
| Pond Engineering Co | xii |
| Queen & Co., James W | xvi |
| Ridlon & Co | xv |
| Rogers, H. A | vii |
| Royce & Mareau | xxi |
| Sawyer-Man Electric Co | xx |
| Schieren & Co., Chas. A | xv |
| Schuyler Electric Co | xxiv |
| Seamons Foundry Co | xx |
| Shaw & Co., J. Elliot | xvi |
| Shultz Belting Co | xix |
| Sigourney Tool Co | xxiii |
| Simplex Electric Co | xvi |
| Southern Electrical Supply Co | xxii |
| Standard Electric Supply Co | xxvi |
| Standard Paint Co | xvi |
| Stanley & Hall | xxiii |
| Star Electrix Co | xv |
| Thomson-Houston Electric Co | v |
| Tropical American Telephone Co | xxv |
| United Electric Traction Co | xxv |
| United States Electric Lighting Co | xxiii |
| Universal Arc Lamp Co | xxiv |
| Vincent & Co., Charles R | xix |
| Walker Electric Co | iv |
| Walworth Mfg. Co | x |
| Washburn & Moen Manufacturing Co | xxv |
| Watson & Stillman | xxiii |
| Western Electric Co | vi & xxv |
| Weston Electrical Instrument Co | vii |
| Wheaton & Co., T. C | xxiii |
| Williams & Potter | xix |
| Wyckoff, Seamans & Benedict | xv |

At a sale of relics in Philadelphia last week, Benjamin Franklin's turnip-shaped silver bull's-eye watch brought $2,100.

Iceland, although without a telegraph line, has telephonic communication between Reykjavik, the capital, and Hafnarfjorthr, a fishing village six or seven miles away.

In our next issue we expect to chronicle the details of the most interesting convention ever held by the National Electric Light Association. There are certainly attractive features enough to make attendance at the convention interesting, and we prophesy that the list of names of the people who come will be longer by several inches than any previous list.

During the past week the bustle and subdued interest preparatory to a National Electric Light Association Convention has been apparent in all branches of the industry.

The phonograph has entered a new field. An enthusiast has recorded the chattering of monkeys, and, after long practice in imitating the sounds, is said to be able to make himself understood by our friends with extended vertebrates. This would tend to prove that the phonograph is the long-sought missing link.

The welding of aluminum with glass is a discovery claimed by Mr. Bradford McGregor, of Cincinnati, O. The press of that city says he has exhibited a large piece of aluminum with a glass tube in the center, and that "when turned on a lathe" the two appear as one homogeneous mass, without flat or joint.

Prof. John P. Barrett, of Chicago, has been appointed chief of the electrical department of the Columbian Exposition. Professor Barrett will add a force and experience to this work that will prove of great value to the electrical industry. It is the desire of all that this department be made one of the leading and most conspicuous features of the Exposition, and John P. Barrett can make it such, with the co-operation of our vast electrical interests.

The New York *Commercial Advertiser*, of February 16, contained a very interesting interview with Lieut. Frank J. Sprague, on the subject of rapid transit for New York. Lieutenant Sprague, of course, advocates an underground electric railway. He thinks that none of the schemes thus far presented would prove entirely satisfactory. The plan he is in favor of is this:

"An independent and way express service, each having double tracks, but having independent paths, run in independent circular iron tunnels, and forming a loop around the city from the Battery to Jerome Park. The express and way tracks to intersect or join at different levels at common stations, and to be operated by electricity. Way tracks to have stations every third of a mile, express every mile and a half. A loop to be provided just south of the Harlem river. There would also be a cross town two-track system running beneath the city division, intersecting it on the east and west sides on the Forty-second street line and at the Battery, and making connection with the Long Island, Broadway and Atlantic avenue station on the east, and the trunk line depots on the west."

### *MORE ABOUT TELEPHONE PROTECTORS.*

It was not the purport of our editorial, in the issue of February 7, to show that none of the protectors now on the market are efficient, but rather to point out, and we did point out, that a great many inventors of protectors have proceeded without a proper knowledge of the requirements. The three conditions to which we alluded must be provided for in any system of protection which is to receive general adoption. The devices which are employed to guard against electric light currents must not be operated by ordinary lightning discharges. They must be so arranged that when connected with a metallic circuit they will operate instantly if the circuit is crossed with a wire which is at a high potential. They must prevent the passage of comparatively delicate currents, the heat from which, stored in the convolutions of a telephone annunciator, would in time start a fire. In addition to this, there are special requirements when the protecting system is applied to modern telephone exchanges, adapted for the use of both metallic and grounded circuits. In such cases all of the grounded circuits are so arranged that they may be converted readily into metallic circuits. This requires a special adaptation and great flexibility of apparatus. Besides this, the style of cable terminals used, and the method of testing employed, must be taken into consideration. In fact, the arrangement of a comprehensive system of protection calls for the highest class of engineering talent, requiring an intimate knowledge of telephony and a thorough understanding of the behavior of heavy currents.

### *KEEP UP WITH THE PROCESSION!*

The REVIEW modestly observes that it is the only American journal presenting Prof. Crookes' able paper on "Electricity in Transitu" in one number. The other journals make of it a story of many chapters spooned out to the thirsty a drop at a time. By means of its usual editorial skill and enterprise, the REVIEW gave it all in a clear, compact and striking form without crowding out a single line of other matter. It seems to have just dawned on the other journals also that there is a Field-Eickemeyer car motor, the details of which the REVIEW shared with its readers months ago.

The moral is obvious. This journal is not an archæological museum, but a bulletin of electrical achievement—and the news it chronicles is as fresh as the morning dew. If you are looking for a chapter on pre-historic antiquity don't apply at this office; if you want to head the procession in knowledge of the march of progress, send in your subscription.

### *A SERMON WITH A FALSE TEXT.*

Our London namesake has for some time past pursued the curious policy, for an electrical journal, of on all occasions giving prominence to reports, however vague and apparently untrustworthy they may be, of fires and accidents said to be due to electricity. Not content with merely copying the utterances of irresponsible newspaper correspondents into its news columns, our enlightened contemporary frequently gives them additional prominence by weighty comment in the section reserved for the often amusing essays evolved from the editorial brains and pen.

In a late issue to hand of the London *Electrical Review* there is a glaring instance of this peculiar fondness for dwelling upon the dangers of electricity. In an editorial headed "Theatre Fires Caused by Electric Light," it is taken for certain, on the authority of a newspaper dispatch, that the "destruction by fire of two New York theatres" (it was only one theatre anyhow) "was caused by the crossing of two electric light wires," and on the strength of this report, a short sermon is read to the electrical fraternity on the dangers of "crosses" and electric wires in general. The electrical fraternity can have few "crosses" harder to bear than to have to read unfounded reports of the "dangers of electricity" in a technical journal accompanied by editorial comment of the most elementary and hackneyed description.

Of course, it was at first suggested that this fire was caused by electric wires, but subsequent investigation showed the suggestion to be entirely groundless.

### *THE ELECTRIC LIGHTING PLANT AT HYDE PARK, MASS.*

Hyde Park, Mass., now comes to the front as dissatisfied with its lighting contract, and proposes to attempt to put the screws upon the electric company by compelling the selectmen of the town to advertise for bids. The selectmen do not believe in this method, but, of course, are obliged to do it under a vote of the town. The plant of the electric company there is very complete and very large; they already have something like 2,000 incandescents and 200 arcs burning. They are giving prices said to be below any in the State of Massachusetts.

The contract which the electric company have offered the selectmen and which the selectmen have accepted, subject to the ratification of the town, provides every practicable safeguard to the town, and is said to be one of the most carefully drawn contracts ever executed between a local company and a town. The local sentiment in the town is that the citizens will ratify this contract, but before it is ratified some of the citizens desire that bids should be asked from other companies. The general tendency of the public seems to be of the idea that electric lighting can be done with little or no actual cost; that everything above $25 per light is profit. The experience of managers of these plants who have been operating them carefully and on a thoroughly business basis for two or three years, shows that $\frac{1}{10}$ of the contracts now being carried out, which were taken during severe competition with large manufacturing companies, are being carried out at a loss to the local companies.

# CORRESPONDENCE.

## OUR WASHINGTON LETTER.

**Postmaster-General Wanamaker's** "limited post and telegraph" bill is dead. Repeated efforts were made in the House Committee on Post Offices to get it favorably reported, but every attempt failed. On the 7th inst., Congressman Evans, of Tennessee, who has undertaken to champion the measure, reintroduced the bill with one important section left out of it. The provision, which has been expunged, made it unlawful for any telegraph company doing business under a contract with the government to engage in the sale of press reports, election reports, market quotations or general news, or be interested in the sale of any such reports, quotations or news. This modification is regarded as a politic concession on the part of the advocates of the bill, but it will have no effect on the final result. Another bill relating to the same subject has been introduced by Mr. Candler, of Massachusetts, which provides for a service quite similar to that contemplated by the Wanamaker bill, but leaves all the details, such as the term of the contract, tariff on telegrams, etc., to the judgment of the Postmaster-General. There is nothing practical about it, and it simply serves to bring the number of bills introduced in the House this session a little nearer 15,000.

The **Thomson-Houston Company** has been awarded the contract of installing an isolated plant in the new building of the Washington Loan and Trust Company.

**President W. R. Plum,** of the Military Telegraph Society, is in the city looking after the interests of the bill giving the old army operators certificates of honorable service, which has passed the House and is now pending before the Senate Military Committee.

The **Patent Office** is just now receiving annual subscriptions to the "Gazette," and an average of four letters, containing five dollars in currency, are lost in the mails every day, while checks and money orders come through all right.

The **Routine Regulations** of the United States Navy have deprived the Electrical Bureau of one of its best men. Lieut. A. W. Grant, who has had charge of all electrical installations on ships built at San Francisco for several years, has been assigned to sea duty. G. C. M.

Washington, D. C., February 14.

## OUR LONDON LETTER.

**London Fogs and Electric Lighting.**—The heavy demands for extra supply during our recent dense fogs have taxed the capabilities of the electric supply companies. The Metropolitan Electric Supply Company have met their difficulties well, and have done everything required, but it is quite a different story with the Chelsea Electricity Supply Company, who have announced their intention to discontinue the supply of electricity between the hours of midnight and 4 o'clock in the afternoon, a temporary measure rendered necessary by the long-continued heavy fogs. The notice was, of course, received with strong disapproval, and a motion has been carried by the Vestry that the Board of Trade be asked to refuse assent to the company's application for a further extension of their order of supply, unless they are compelled to afford a continuous supply both day and night.

**Burlington Arcade, Piccadilly.**— Discussion and doubt are at an end, and the Burlington Arcade is at last lighted by electricity. The work has been successfully carried out by Messrs. Freeman & Company of Swallow street, Piccadilly. There is a row of pendants with opal shades and 50 candle-power lamps, current being supplied from the St. James' circuit. The extra expense of first installation caused the opposition of many tenants, and has greatly delayed the carrying out, but several of the shops have now adopted the electric light for inside also.

**Lord Ardilaun's Residence, Ashford, County Galway.**—A most important installation of the electric light has just been completed by the Electrical Engineering Company of Ireland, at the mansion of the Right Honorable Lord Ardilaun, in Ireland. Nearly 250 glow lamps have been put in, ranging from 10 to 150 candle-power. For driving the dynamo a new patent jet water wheel is employed, made in Chicago to the special order of the Electrical Engineering Company. Water power is provided by two large pumps, driven by turbines situated a mile from the house. The water is delivered at great pressure on the wheel—being pumped through large pipes—which is the most important point in the proper and most economical working of jet wheels. Dynamo and wheel are in a specially built house, the current being carried through lead-covered cables imbedded in the ground, into the accumulator room, situated in the basement of the house. The main switchboard is in the accumulator room, from which branch off the various mains and cables distributing necessary current through the building. Lord Ardilaun has expressed his thorough satisfaction with the way the installation has been carried out. The Electrical Engineering Company had a very charming exhibit at the recent Balls Bridge show, and at the show-rooms, 61 Dawson street, Dublin, may be seen apparatus and machinery suitable not merely for the modest requirements of private houses, but also for the more important work of central stations for lighting cities and towns.

**The Electric Railway.**—The success which has attended the working of the City and South London Railway and the great popularity it has achieved with the travelling public, has led the inhabitants of Peckham and Dulwich to draw up a largely and influentially signed memorial praying for an extension to their district of London. The Camberwell Vestry officials will place the matter before the South London Railway Company directors, and will suggest as a route from the Elephant and Castle through the Walworth Road to Camberwell Green, and then through the Peckham Road to East Dulwich and Nunhead. The London, Brighton and South Coast Railway, which at the present time covers the district, has its terminus on the south side of the Thames, and the crossing over the London Bridge on a bad morning is far from being pleasant. Certainly a populous neighborhood will be saved great inconvenience should the proposal be carried out.

**The Paris-London Telephone Line.**—It is now stated that this telephone service which was to have been opened at the beginning of the year, will now be inaugurated on March 1, and there is a rumor that the inauguration will consist in the exchange of greetings between Her Majesty, the Queen, and M. Carnot, the French president. In France, the Minister of Commerce, M. Jules Roche, is now engaged in drawing up the conditions for the working of the service. The charge for a three-minute conversation is to be 10 francs, of course, at first experimental, and if experience should render advisable, to be afterwards reduced. The telephone to be open for use at any hour, day or night. On the 15th February the cable will be submerged and the official trials will last until the end of the month. CHARLES FFRENCH.

London, February 1.

## OUR ST. LOUIS LETTER.

**Mr. James A. Carr,** late of the electrical department of the Patent Office at Washington, has established an office in this city. As a patent lawyer, thoroughly versed in electricity, he is a valuable acquisition to St. Louis electrical circles.

**Suburban.**—Chester, Ills.: This city is strongly in favor of electricity for city lighting, and will endeavor at the April elections to place in office a mayor and board of aldermen who are in favor of this project. The plan suggested for securing this change is to reduce the interest on the city's bonds to a lower per cent., and then employ the difference in the establishment of a plant.—Martinville, Ills.: The peculiar action of the Postal Telegraph Company in placing its poles in this town has excited no small amount of comment and indignation. This company was granted the right to place its poles along the National road, and in return for this privilege the company paid the city $125. When it came to erecting the poles, as the residents on either side of the road objected to the placing of the poles on their side, the company took the only alternative and placed them in the center of the thoroughfare.—Monticello, Ills.: Monticello is the latest acquisition to the list of towns to be lighted by electricity. The city council has just accepted a contract for lighting the city by arc lamps of 2,000 candle-power each. The contract holds for 10 years. W. E. Smith, H. E. Houston and Reber Houston form the electric light company. It is the intention to supply public buildings with incandescent lights.—Champaign, Ills.: In the case of the street railway company against the mayor, aldermen and city of Urbana. Judgment in favor of the railway company has been rendered. This decision enjoins the mayor, *et al.*, from preventing the street railway people placing electricity on the line as the motive power.

St. Louis, February 10. W. H. B.

## OUR ALBANY LETTER.

**Mr. Gunther** introduced a bill in the Assembly Tuesday amending the act incorporating the Buffalo Niagara Power and Drainage Company. It increases powers of a company generally, allows them to have a capital of $10,000,000, and increases the time in which the work must be commenced for ten years from the passage of the bill. The company is authorized to supply any cities, towns and villages in Erie or Niagara counties with water, electric light and sewerage and drainage. Mr. Laughlin introduced the same bill in the Senate.

**The Assembly Committee** on gas, water and electricity will report favorably the following bills to that house: Mr. I. Sam. Johnson's, applying the law preventing the granting of exclusive franchise to electric light companies to villages; Mr. Gorman's, to establish a board of electric light commissioners in West Troy.

**The Saratoga Board of Fire Commissioners** and Board of Street Commissioners, at a joint meeting, Monday evening, came to the conclusion that public safety demands a change in the mass of wires that run at every angle on Broadway in the noted watering place.

**Jamestown, N. Y.,** has had a great street railway controversy. It has at last been settled by the common council giving the street railway permission to use certain streets, and to change its motive power from horses to electricity. The company has entered into a contract agreeing to pay into the city treasury three per cent. of its gross earnings annually. This is the largest per cent. permissable by law in cities of its size. The citizens are pleased with the settlement of the controversy on such good terms.

**The Postal Telegraph Company,** of Buffalo, has rewarded the popular manager, Mr. Harvey D. Reynolds, with the appointment of superintendent of the fifth district of the company, with headquarters at Buffalo.

**It is said** that the first cost of an electric plant to operate the seven Rochester light bridges will be between $35,000 and $40,000, with expenses of $5,000 annually for operating.

**The American Telephone and Telegraph Company** has connected the long distance line with Binghamton, N. Y.

**It is Probable** that the villages of Waverly, Sayre and Athens, N. Y., will soon be connected by an electric line. The prime movers in the scheme are H. J. Baldwin, of Waverly, and the well-known railroad contractors, Ryan & McDonald, who helped to build the Delaware, Lackawanna & Western Railroad, and are now building a belt line in Baltimore, Md.

**Every Electrical Interest** in this city was paralyzed Saturday, when a wet, soggy snow storm set in. The first indication of the trouble was the sagging of the wires of the Hudson River Telephone Company until they broke with the burden of snow and fell upon the trolley wires of the electric railways, sizzing and burning like electrical snakes. Pedestrians watched the display of electrical pyrotechnics, but were forced to dodge the falling wires incessantly.

**The Telephone Company** was first made aware of its position by the burning of its great switchboard. A man was sent into the cupola with an ax to cut out the wires. This could not be accomplished before the switchboard was damaged to the extent of several thousands of dollars. The board was new and recently put in at a cost of $22,000. The severing of the wires, of course, destroyed the telephone service of the city. So great became the frequency of falling wires and crosses in telephone, telegraph and electric railway circuits, that Mayor Manning deemed it advisable to order something done. He first called upon the electric light company to shut down their plant. This was done, and the city was plunged in almost Stygian blackness.

Then the electric railways were ordered to shut down and had to obey. This cut off local transportation, and pedestrians were forced to pick their way to their homes over the fallen wires and through darkened streets. The companies, however, sent out linemen at once to gather up the wires as fast as they fell. The telegraphic service, both Western Union and Postal, was paralyzed for some hours. At last a few lines were worked. The cause of the trouble with the telegraph companies was the telephone muddle.

All of seven huge telephone poles, bearing hundreds of wires and many big cables, fell to the ground, crushing with them the lines of the telegraph companies, as well as bearing those of the telephone company. The fire alarm system was utterly useless, the only sign of its existence being an occasional toll of the City Hall bell, the chief fire bell, when its lines received some foreign electrical current. Patrols of firemen and mounted police were scattered throughout the city, to give immediate alarm in case of fire. The city was practically transferred to olden times. It was vividly shown what an immense figure in the product of progress and advancement electricity is. Had the wires been underground, the accident to the different companies would not have happened.

All day Sunday the condition of affairs remained the same. The electric light plant was not allowed to run, nor the electric railways, for fear the currents would get into some of the crossed and fallen wires and cause fire. The city was in darkness Sunday night. Monday, however, the wires were so far untangled and repaired that the mayor allowed the motor cars to run, and Monday night the lights were lighted. The telephones were not in use all the week. The company's loss will probably foot up $30,000. They will put their wires underground as soon as the common council grants permission. The telegraph companies or the railways did not sustain very heavy losses. L. M. W.

Albany, Feb. 14, 1891.

### An Important Railway Contract.

Messrs. Chadbourne, Hazelton & Company, general agents for the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, have just closed a contract with the Denver, Lakewood and Golden Railway Company, of Denver, Colo., for an extensive electric railway. This road runs from the heart of Denver directly across the country to the city of Golden, a distance of 14 miles, passing through several smaller towns on the way. The grading on this road is completed, and the work of laying the rails is about to commence; 60-lb. T rails will be used. This road is the only direct communication between these two cities, and Mr. Starkweather, vice-president and general manager of the road, claims that the freight business alone on this line will pay a 10 per cent. dividend on the investment.

The equipment at first will consist of two 100 horse-power motor cars, designed by Mr. Leonard Atwood, the mechanical expert employed by Messrs. Chadbourne, Hazelton & Company. These motor cars will be fitted with special Wenstrom slow speed, direct geared motors, designed by Mr. H. F. Parshall, on the same general lines as the regular Wenstrom-Parshall slow speed street car motor. These are guaranteed to run 25 or 30 miles an hour, and haul loaded freight cars.

For the passenger traffic, long eight wheel cars with pivotal trucks will be used. These cars will be handsomely fitted up, and have a seating capacity of 40. Two standard Wenstrom slow speed, direct geared motors, 30 horse-power each, will be put on these cars. They are calculated to run 15 or 20 miles an hour, hauling two other trail cars.

The power plant will be divided in two sections; one station being in Golden, the other near Denver. Each one will be fitted up with four 80,000 watt Wenstrom street car generators, of the newest and most approved design, together with the necessary steam plant to operate them. No money will be spared to make this road complete in every detail.

Chadbourne, Hazelton & Company have had their expert, Mr. Atwood, in Denver for some weeks going carefully over this work, and laying out necessary plans for the successful equipment of the entire line. It is intended to have the road open for traffic as near the first of May as possible. They expect to increase this equipment very materially during the Summer, as the traffic over this line is expected to be very great.

### Brooklyn Institute.

The Brooklyn Institute will celebrate the anniversary of Washington's birthday this year on Monday evening, February 23, in Association Hall, Fulton and Bond streets. Mr. George William Curtis will deliver an address on "Charles Sumner." Mr. Curtis' lecture will be the first of a series on American statesmen. The full course is as follows:

Monday, February 23—Hon. George William Curtis, on "Charles Sumner."

Monday, March 2—Rev. Charles H. Hall, on "Thomas Jefferson."

Monday, March 16—Dr. Truman J. Backus, on "Alexander Hamilton."

Thursday, April 2—Hon. Carl Schurz, on "Abraham Lincoln."

Thursday, April 16—Rev. John W. Chadwick, on "Daniel Webster."

## FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Friday, February 13, 1891. New York, Boston and Washington Stock Exchanges. Pittsburgh closing February 12

| | |
|---|---|
| **NEW YORK.** | |
| Western Union Telegraph Co. | 80¼ |
| American Telegraph & Cable | 88 |
| Central and South American | 145 |
| Mexican | 210 |
| Commercial Cable Co. | 104 |
| Postal Telegraph Cable | 39 |
| Edison General Electric Co. | 102 |
| Consolidated Electric Light | |
| Edison Electric Illuminating Co. | 79 |
| United States Electric Light | 30 |
| North American Phonograph | |
| **BOSTON.** | |
| Thomson-Houston Electric Co. | *45 |
| " " " Preferred | 25¼ |
| " " " Series C | |
| " " " Series D | 6¼ |
| " " International Co. | |
| " Welding Co. | |
| " European Welding Co. | 60 |
| Ft. Wayne Electric Co | 11⅝ |
| **TELEPHONE:** | |
| American Bell | 191 |
| " Rights | 17⅛ |
| Erie | *47 |
| New England | 50¼ |
| Mexican | .65 |
| Tropical American | |
| **MISCELLANEOUS:** | |
| Edison Phonograph Doll | |
| **WASHINGTON.** | |
| Pennsylvania Telephone | 25 |
| Chesapeake and Potomac | 56 |
| American Graphophone | 8¼ |
| United States Electric Light (Wash'ton) | 140 |
| Eckington and Soldiers' Home Electric Railway | 56 |
| Georgetown and Tennallytown | 60 |
| **PITTSBURGH.** | |
| Westinghouse Electric Mfg. Co. | 11⅝ |

* Ex. Div.

## Telephonic News

*** At Akron, O., the Telephone Company is putting up 90 foot poles, costing $35 each. Wires will be cabled in many cases, and street car induction troubles and electric light dangers all avoided.

*** John Sweeney, who was arrested at Twenty-third street and Eleventh avenue for cutting telephone wires, was arraigned last week in Special Sessions on a charge of larceny. He was committed to the penitentiary for four months.

*** The Des Moines, Ia., city council has just passed an ordinance, after a hard fight, declaring that the telephone company must donate 15 'phones to the city and pay for the use of a franchise, which grants it the right to string wires over the streets, three per cent. of its gross earnings. The company will not accept the provisions of the ordinance.

### PERSONAL.

Mr. E. W. Burdett has registered as legislative counsel for the Massachusetts Electric Light Association.

Dr. W. F. Bradner, president and manager of the Bradner Adjustable Hanger Company, of Denver, made the REVIEW a call last week.

G. S. Russell, of Marlboro, has been elected assistant treasurer of the Johnston Electric Train Signal Company, of Woburn, Mass.

Lyman D. Davis, an electrician and a nephew of Governor Hill, died at his house in Newark, N. J., early in the morning of January 24th.

Mr. J. R. Burdick, formerly in the insulated wire business, has accepted a position with the H. W. Johns Manufacturing Company, of 87 Maiden Lane, this city. Mr. Burdick has a host of friends in the electrical field who will be glad to welcome him in his new work.

Mr. Chas. E. Brown, who has been well known in the metal trade, having been for many years connected with the Brooklyn Brass & Copper Company, has accepted a prominent position as sales agent with the Bridgeport Copper Company, Bridgeport, Conn. His many friends wish him much success.

The death is announced of M. Emile Reynier at the early age of 40. The deceased will be remembered for the work he did in connection with batteries and accumulators. He was born in Paris and was apprenticed to engineering, but devoting his leisure to scientific pursuits, he made several more or less important inventions in connection with electricity, and worked with M. Faure in the development of the latter's accumulator. M. Reynier was the author of several works in connection with his favorite science.

Mr. John Henry Alley, of Lynn, Mass., died very suddenly in that city, February 9. Mr. Alley began his business career in the house of Abbott Lawrence, and was afterward of the firm of J. Bertram & Sons. He left them to enter the New England Weston Electric Lighting Company, with headquarters in Boston. He had been in the latter company for 15 years past. Of late he had been largely interested in the Union Electric Car Company, of Boston, which has managed the storage battery street car system now running from Beverly to Danvers.

### Villard Denies It.

Mr. Villard authorizes *Kiernan's News Bureau* to say that the rumor that he has sold out all his holdings of Edison General Electric Company's stock to the Vanderbilts is untrue; and that he is the largest individual holder of this company's stock.

### Modern Uses of Electricity.

TO THE EDITOR OF ELECTRICAL REVIEW:

I cannot abstain from making a few remarks and additions to the address delivered under the above title by Dr. Moses G. Parker before the Young Men's Christian Association, at Lowell, Mass., and published in the ELECTRICAL REVIEW for January 21, page 276.

I will not touch the condensed history of electric science, by which the subject is introduced, as this is very complete, considering

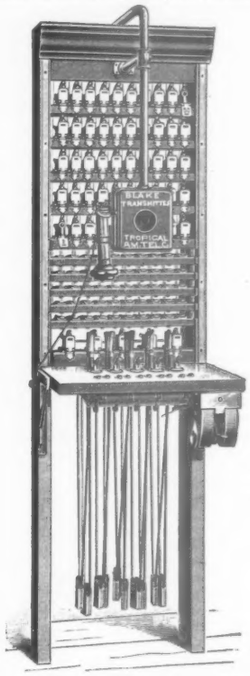



FIG. 2.—WILLIAMS CORD SWITCHBOARD.

the comparatively small place it occupies, but will commence with the statement made at the base of the second column, which reads thus: "In 1873 Faraday * * * produced the first experimental machine for the mechanical production of electrical currents." I hope that the date is a misprint, as otherwise it does him great injustice in regard to his priority, while at the same time it gives him a credit which he does not deserve, namely, that of being the first in this line. It is true that he was the first to produce revolving motion by an electric current, but he was not the first to produce a current by motive power. It appears that it was with Faraday once, as it is in our time with Edison—great as their merits are, they are made still greater by those who are not well informed, and who give them all the credit of the labors of others who preceded them, but of whom they never have heard. It is needless to specify this, as all electricians know.

In regard to the first experimental machine for the mechanical production of electric currents, I will call the attention of Dr. Parker to the number of the *Philosophical Magazine* for August 2, 1832, where a letter is found, signed P. M., which describes such a machine, consisting of six coils of wire, in front of which steel horseshoe magnets revolve; next I call attention to Pixi, who one month later (September, 1832), exhibited a current generator in which a steel horseshoe magnet was made to rotate under a soft iron electro-magnet, in the coils of which he obtained a series of alternating currents, while soon after he caused it to be brought in the same direction by his invention of the commutator.

Then came the so well known Clarke's machine, and in 1843 Stoehrer's, of which in 1850 I saw a very fine specimen in Prof. John W. Draper's laboratory in the University Medical College. It was later, with several other valuable specimens of the history of electricity, destroyed by fire; all these were magneto electric generators.

Next came Wilde's generator, who placed an auxiliary magneto-electric generator on top, for charging the large electro-magnets, which aided to produce the final current. After this came Ladd's machine with two revolving armatures one at each end; a fine specimen of this was among the large collections I donated to the Brooklyn Institute, which, unfortunately, was also destroyed by fire, with most of my other historical specimens.

So much to do justice to the pioneers in this line. I come next to a grievous error. It is stated by Dr. Parker that Gramme improved the shocking machine of Paxton, of Philadelphia, and made the Gramme dynamo which was exhibited in Vienna, 1873; that by accident he discovered that the current of one such machine would set another one in motion, and that so the first practical electro-motor and the transmission of power over a wire was born. That this is a fable will be evident from the following facts:

Practical motors were made before 1830; even after the invention of the electro-magnet by Sturgeon; they were worked by a galvanic battery, and, as a matter of course, it was afterwards expected that they would move by currents from the machines described above. The writer of this paper made in 1840-1845 working models of each motor in a great variety of forms, in order to find practically which form would be the most available. Many others did the same thing, but at the head of them all stands Pacinotti who, in 1860, constructed a most ingenious motor, with an armature in the form of a ring revolving between the poles of an electro-magnet. Previous to this, all motors had armatures similar to those of the machines above described for the generation of electric currents; in fact, the latter machines were nothing but motors, with their functions inverted, which means that in place of applying an electric current to produce motive power, motive power was applied to produce an electric current.

The most celebrated of these motors were those of Negro, of Italy, in 1830, Jacobi, of Petersburg, in 1839, Elias, of Holland, in 1842, Froment, of France, 1844-1850, Hjorth, of Sweden, 1851, Page, of Washington, 1852, and last, but not least, Pacinotti, of Italy, 1860.

The superiority of the latter motor was that it did not operate by alternate impulses, but that the revolving armature was driven by a steady pull; this made it especially adapted to a reversion of its functions, namely, to change it from a motor into a current generator, when revolved by any source of power, in which case it would produce a steady current in one direction. There is documentary evidence that Pacinotti foresaw this, as he mentioned it in his description, but he did not build a machine for this purpose, and the credit for this belongs to Gramme, of Brussels, who modified the ring of Pacinotti to what is now known as the Gramme ring, which, at present, is mostly made in the form of a drum.

It is perfectly certain that Gramme knew beforehand that the Pacinotti motor would be put in motion by any proper electric current, as several electricians long before that time had reached the fact that the current of a Pixi or Clarke magneto electric generator would cause another of the same kind (or, in fact, any other proper kind of electric motor) to revolve. Among those experimenters I have the satisfaction to count myself. I exhibited it to my Class in Physics at the Cooper Institute, New York, in 1862 or 1863, when my suggestion that in the far future motive power might be transmitted by an electric current over a copper wire was received with an incredulous smile.

I was so satisfied that every practical electric experimenter knew this simple fact, what *a priori* was to be expected, that I did not draw much attention to it, because sufficiently strong electric currents could not be obtained before the introduction of the dynamo.

In regard to the velocity of electric transmission, as given by Wheatstone, 288,000 miles per second, greater than the velocity of light. It ought to be added that these old experiments were made with static electricity alone, which is of a very different nature than the kind of currents at present transmitted over telegraph wires and cables. This difference is that the static currents are enormous in voltage or pressure, which runs in the hundreds of thousands, and, therefore, are very little influenced by resistance, while the kind of electricity at present used for practicable purposes, is enormous in quantity but comparatively small in voltage, and very largely influenced by resistances. Fereau found the velocity is 111,700 miles per second in copper wire, 62,100 in iron. Then must be added the influence of inductive action when wires are on telegraph poles with other wires near them. This proximity retards the current, which is more rapid when on high poles and slower in proportion where it is nearer to the ground, and slowest of all in submarine cables.

In regard to the discussion of the ring weld, it is asked why the current passes across the ununited part rather than through the continuous iron. This question is based on the old idea that the entire electric current will go through the path of the least resistance. This idea is erroneous. A current will go through every path offered, but subdivides itself in ratio of the conductivity of the different paths. At first all the current used for welding will go through the continuous iron, but as soon as the broken ends are brought in contact a portion will go through these, and heat them by reason of the greater resistance there. When the joint is being made the rise of temperature will increase the resistance, and this will still more increase the heat. When, finally, the joint is connected the current will be equally divided over both paths. The only condition is that there be current enough to heat the joint even when half or more of it passes over another path.

P. H. VAN DER WEYDE, M. D.
Brooklyn, N. Y., February 14, 1891.

### Williams Switchboards.

The Tropical American Telephone Company, 95 Milk street, Boston, controls the exclusive rights to make and sell in South America, Central America and the West Indies, the switchboards illustrated on this page. Fig. 1 shows the Williams peg board. It is five feet one inch high, three feet one inch wide and two feet three inches deep from front to rear, and arranged for table operators. Recent improvements have been made in the details, including the drops and the cabinet work. The boards are lettered and numbered 1A, 2B, 3C, etc., and can be placed side by side, connecting each table

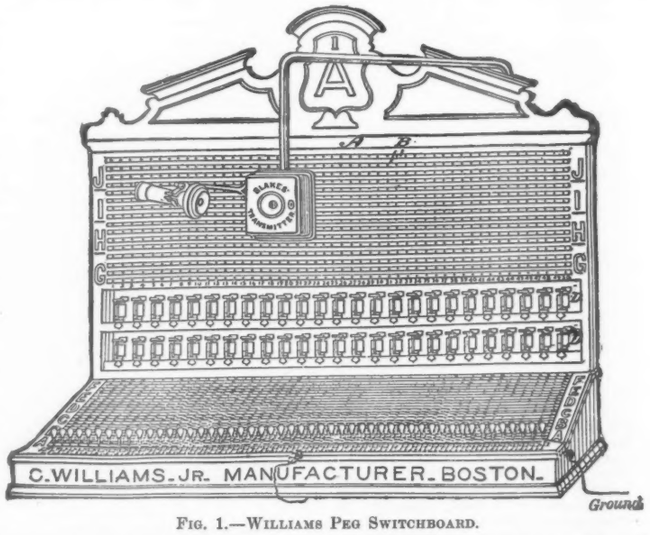



FIG. 1.—WILLIAMS PEG SWITCHBOARD.

with the next. The drops used are the Hynes or Williams drop.

The Williams cord board is shown in Fig. 2. It is fitted with annunciator drops and automatic switches and keys for calling and connecting telephone to subscribers' circuits. In this board the movements necessary to connect and disconnect subscribers are reduced to a minimum. By the use of superior stock in the construction of the frames and cords, and with weights to take up the slack of the cords, a simple but perfectly reliable and durable board is produced. The drops used are the Hynes or Williams drop. Complete boards for 50 lines are 16½ inches wide and 18 inches deep, and rise 62 inches from the floor.

### A Novel Multiple Telephone Switchboard.

A new multiple device for telephone switchboards has recently been patented by Mr. C. E. McCluer, the well-known telephone manager, of Richmond, Va. Extended experience has proved it to be practical, economical and reliable.

The accompanying figure is designed to represent three sections of a multiple switchboard. $P^1$, $P^{11}$ and $P^{111}$ represent the connecting plugs attached to the flexible connecting cords $K^1$, $K^{11}$ and $K^{111}$, the other ends of the cords being electrically connected together through the secondary coils of the inductoriums $C^1$, $C^{11}$ and $C^{111}$. B is a local battery and V a rheotome or circuit breaker connected up with the

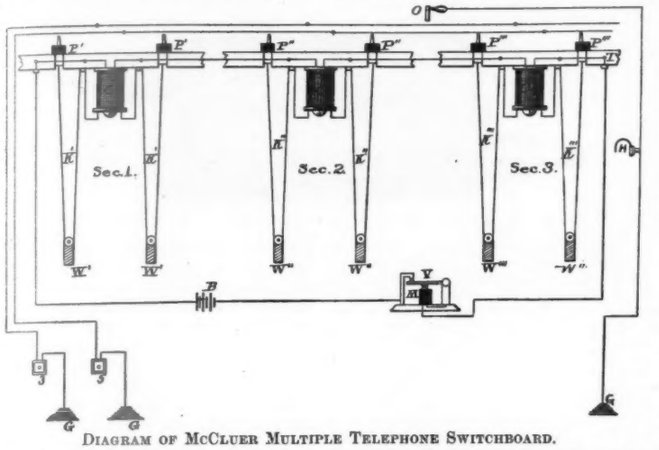



DIAGRAM OF MCCLUER MULTIPLE TELEPHONE SWITCHBOARD.

primaries of all the induction coils on a given section, in series, and with the various sections in multiple arc. O represents an operator's testing plug connected to earth G through the operator's head phone H; 3 and 5 are intended to represent subscribers' stations connected to earth, while the lines enter the central office and are connected in series to thimbles, springjacks or other suitable commutators located on the various switchboard sections.

The operation of the device will now be readily understood.

The battery B and rheotome or circuit breaker V being connected up in local metallic circuit with the primaries of the induction coils, an intermittent current from the battery will, of course, pass through each induction coil as long as the rheotome continues to alternately open and close the circuit. In practice it has been found best to use an adjustable circuit breaker, furnished with a polarized armature and driven by a special local battery. Such a rheotome admits of a wide variation in the speed or rapidity with which the electrical pulsations succeed each other, and can be readily adjusted to suit special conditions.

If now, while the electrical pulsations from the battery B governed by the swing or play of the armature of the rheotome V, one throbbing through the primaries of the induction coils K, a pair of plugs, say those on section 1, are connected to subscribers' lines 3 and 5, respectively, circuit is established between the two stations through the two lines, the earth intermediate between the two stations, and the plugs $P^1$ flexible, connecting cords $K^1$ and the secondary of the induction coil $C^1$. It will now be readily understood that a succession of electrical pulsations will be induced in this second circuit by the intermittent current passing through the primary of the induction coil $C^1$ and this induced circuit will continue to traverse the two subscribers' lines as long as they are connected together through the secondary of the induction coil $C^1$, or as long as the intermittent current continues through the primary of the coil $C^1$.

If, now, the operator at another section of the switchboard, say section 3, receives an order for a connection with either line No. 3 or 5, she first applies her testing plug O to the commutator of, say line 5 on her section, when a portion of the induced intermittent or alternating current flowing over line 5 will be diverted through her head phone H to the earth, indicating to her practised ear at once and unmistakably that No. 5 is "in use"; and so with any section or any line. If the line tested is "in use" the unmistakable ticking due to the alternating induced current, like the gentle ticking of a watch held to one's ear, will be heard.

Conversely, the absence of the rythmic watch-like ticking will indicate line not in use. By varying the strength of the primary battery, or by increasing or diminishing the size and convolutions of the primary and secondary wires of the induction coils, or by interposing artificial resistance in either the primary or secondary circuits, the strength of the induced intermittent or alternating current passing over the subscribers' lines can be regulated to a nicety. So that while insuring its ready detection by the operators, the methodical beat of the rheotome shall not be loud enough to interfere with the satisfactory use of the telephones by the subscribers. In practice, it is found that six cells of an ordinary Daniels or gravity battery is ample to operate satisfactorily six sections of induction coils, there being 44 coils to each section connected up in series, while the six sections are connected up in multiple. At first the coils were wound on cores consisting of two-inch R. H. B. screws, with copper washers soldered to them to form the spool ends, but it was found almost as cheap and more convenient to use wooden spools on which to wind the primary and secondary coils, with the R. H. B. screws passing through them and still forming the cores, the points of the screws protruding far enough to enter the supporting shelf or table and hold the induction coils securely in place. As the completed coils are only one and a half inches long and one-half inch in diameter, they take up but little room, and once in place they never give trouble.

It might naturally be inferred that the noise on the talking circuits caused by the induced currents arising from the combined action of the rheotome and induction coils would seriously interfere with the satisfactory use of the telephones, but several years experience has proved that such is not the case. The rythmic watch-like beat of the rheotome translated to the telephones through the medium of the induction coils while plainly audible to the listener does not interfere in the least with the utterances of his correspondent, which are as clear, articulate and distinct as they would be on a perfectly quiet circuit.

On circuits seriously affected by extraneous currents, due to leakage from electric light and power systems, this multiple test would undoubtedly be placed at a disadvantage. But when the intense quiet of the metallic circuit system prevails, the subdued but plainly audible pulsations of the induced current from the rheotome and induction coils, we are informed, not only offers no impediment to the satisfactory performance of the telephones, but on the contrary actually enhances their efficiency by veiling or drowning the faint inductive cross-talk from other and contiguous circuits, which would otherwise annoy the parties engaged in conversation.

The presence of the multiple test indication on his line indicates to the subscriber the precise moment at which the central office operator obeys his order for a connection, or informs him of any delay in making the connection, thus offering an incentive to the operator for a quick performance of her duties. If the subscriber hears the multiple test immediately after giving his order, he knows that any delay in securing a speedy response from the station called is due to tardiness on the part of the subscriber in answering his call, not to any lack of celerity on the part of the operator. The operator, and through her, the exchange service, is thus relieved from much of the unfounded and unjust complaint ordinarily heaped upon them by impatient and unreasonable subscribers.

It is claimed that the application of the McCluer multiple test to existing magneto boards is accomplished at an insignificant expense; and that the application of this multiple test to a new magneto board designed for use either in connection with an ordinary grounded circuit system, or a compound metallic circuit system, greatly lessens the complication and expense of wiring, only a single wire being necessary for each number, instead of two.

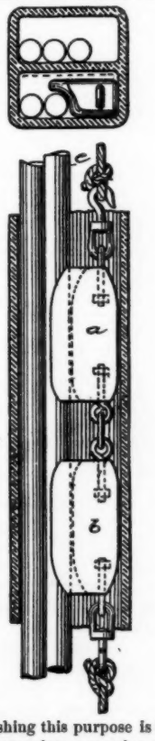
McCluer's device has been applied to the 1,200 wire Law board now in use in the Richmond, Va., exchange, having superseded the multiple test with which the board was originally constructed, the change having been effected without a moment's interruption to the exchange service. Nearly 900 stations are being satisfactorily handled on six sections of the multiple board by a corps of 10 operators, with an almost entire absence of double or cross connections of which a multiple board is usually so prolific.

Of the 24,000 people who avail themselves daily of the Richmond exchange service, not one, it is said, ever makes any complaint or remark even regarding the presence of the multiple test on the talking circuits. It does not seem to be noticed at all, but it undoubtedly serves to render the silence of the compound metallic circuits less oppressive, at the same time veiling the cable and long line induction from the perception of the subscribers.

The McCluer multiple device is also in successful operation in connection with an 800 wire Law board at Norfolk, Va., which was constructed with special reference thereto.

### Laying Electric Cables.

In drawing electric cables through underground ducts, when two or more such cables are used, the one first laid in the duct, by reason of irregularities in position, is liable to chafe and create weaknesses or bare spots in the second or subsequent cable when it is being drawn through the conduit. In order to overcome such liability it has been proposed by Mr. Charles H. Wilson, of Chicago, to draw through the conduit, after the first cable is laid in position, a block designed to force the first cable into perfect alignment with the side of the conduit before the subsequent cables are introduced. The device




for accomplishing this purpose is illustrated in the accompanying engraving, the upper part showing the conduit in cross-section and the lower part in longitudinal section. A conduit containing two or more conductors is shown, each of which, after being introduced into the conduit, is straightened into perfect alignment therewith by means of a block or series of blocks or wedges, *a b*, containing a suitable groove for crowding the conductor to one side of the conduit. A series of blocks of progresively decreasing size is used which are brought into service in succession as the number of cables laid increases.

## TELEGRAPHIC

.... A system of electric telegraph alarm is projected at Rochester, N. H.

.... The farmers' telegraph line in Lenawee county, Mich., now connects 131 homes with 68 miles of wire.

.... The telegraph wires in Central New Jersey are again in working order, and business is being transacted as heretofore.

.... Jay Gould seems to have smothered the postal telegraph scheme. Its friends think it will come s'm'other time, however. —*Boston Herald.*

.... The Rocky Mountain Telegraph Company's line will arrive in Spokane, Wash., it is confidently expected, during the summer of 1891. Lower rates are then expected.

.... The Commercial Telegraph Company is the name of a co-operative telegraph company which some adventurous spirits in Jefferson and McKean counties, Pennsylvania, have started out to organize. In a circular it is stated that the stock will be sold at $10 per share, payable in instalments; that only telegraphers will be allowed to hold stock and that all the work will be done by stockholders. The projectors claim to have placed a large amount of stock, that a charter will be applied for at once and that over 5,000 telegraphers will shortly be interested. These names are given in the prospectus: D. N. Hipps, Brockwaysville, Pa., secretary; C. T. Winslow, Punxsutawney, treasurer; J. D. Pease, Bradford, traveling solicitor; J. B. and W. B. Chapman, Bradford, attorneys. Pittsburgh telegraphers say they know nothing of the project.

.... Mr. Eckert figures the cost to the Western Union of replacing the damaged wires and poles and of restoring the property to its previous condition at $41,000, and allows $10,000 for general expenses in connection herewith, making a total of $51,000 direct loss. The loss of revenues on account of the temporary cessation of business will not exceed the sum of $15,000, so that the entire loss is only $66,000. The receipts of the company average about $70,000 per day. The following table shows the test office receipts for each of the past five weeks, compared with the two previous years:

| Week ended— | 1891. | 1890. | 1889. |
|---|---|---|---|
| January 3..... | $208,229 | $193,886 | $180,804 |
| January 10..... | 227,087 | 209,454 | 197,056 |
| January 17..... | 234,006 | 210,268 | 201,701 |
| January 24..... ... | 228,439 | 215,177 | 200,176 |
| January 31 ..... | 216,138 | 217,730 | 200,459 |
| Total five weeks.. | $1,113,899 | $1,046,515 | $980,196 |

### New York Electric Club.

**At the Next Meeting,** February 26, as published in these columns last week, rapid transit matters will be discussed after a good dinner. It is expected that the Mayor and the members of the Rapid Transit Commission will be present.

**At this Meeting,** in pursuance of a notice given at the last regular meeting of the Club, action will be taken on the following proposed amendment to the by-laws:

"To add the following to Article IX, to be called Section 2.

"Any By-Law may be suspended for a period not exceeding three months by a majority vote of the Active Members present at any regular meeting or adjournment thereof, or by a two-thirds vote of the Active Members present at any special meeting."

In case the same should be acted upon favorably, a resolution will be submitted to suspend for three months that portion of the by-laws which fixes the initiation fees for active and associate members, and to admit new members during the same period on the payment of one-half of the regular initiation fee.

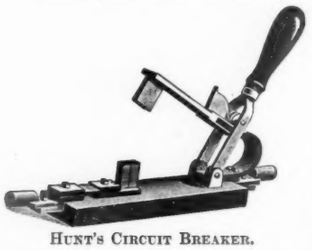
* * The advisability of operating the lift bridges over the canals at Rochester, N. Y., is being considered by the city authorities.

* * The plant and cars of the Danville Electric Street Car Company, at Danville, Va., were destroyed by fire last week, and the city is without street car service. The loss on building, cars and machinery is estimated at $29,000; insurance $12,000.

* * The Edison General Electric Company has commenced suit against the Electric Rapid Transit Company to recover possession of a large amount of electric goods, or $50,000, value thereof, and $30,000 damages for withholding the same. The defendants are the owners of the electric railways in Los Angeles, Cal., and are now in possession of an electric plant belonging to the plaintiff.

### Hunt's Circuit Breaker.

The importance of serviceable and efficient circuit breaking devices is becoming more apparent with the progress of electric light and power. The Hunt Engineering Company, 238 Washington street, Brooklyn, who have lately brought out many new and useful improvements in electrical devices, have just put upon the market a single and double pole switch which possesses many advantageous points that are apparent.



HUNT'S CIRCUIT BREAKER.

Our cut represents the switch, which, as can be seen, is an entirely new departure from anything which has yet been put upon the market. The switch being mechanically perfect, the action is automatic and almost instantaneous. Great care and attention have been given to the contact points, which are put together as a ground joint in such a manner that a perfect contact service is secured over the entire surface of the knife and brushes, and by the scraping made in making and breaking the circuit, insures a clean and bright surface at all times. There are no separated copper leaves on the extension bar to accumulate dirt and corrosion, which often result in poor contacts and heating; and the extension bar carrying the knife being made of brass instead of wood, it is impossible for it to change its position by the loosening of screws and washers.

These switches are mounted upon slate bases to which are attached, in connection with the switch, a T and bus bar connector and fuse block, which makes a complete instrument for mounting on a switchboard, and saves much trouble in connecting up. The switches can be made of sufficient capacity to carry any tension of current, and can be adapted to all uses which other switches are put to, both in isolated or central light and power stations. The extreme simplicity of this switch will allow of its being manufactured and put on the market at prices much lower than many of the other switches which do the same work, and which are more complicated and require more attention. During the past few months, the Hunt Engineering Company have installed, throughout different cities and towns in the United States, isolated and central station apparatus for a capacity of nearly 10,000 lights; and in introducing these new appliances which they are bringing out, they have succeeded in overcoming many of the weak and defective points in some of the electrical devices used in construction work, brought to their notice by their extensive experience.

### Auburn City Railway Company, Auburn, N. Y.

The lines of this company have been equipped for electricity during the past Summer and cars have now been running on three branches for two weeks. The entire road-bed has been overhauled and relaid with new rails; a 45-pound T rail and a 50-pound Wharton girder being used. An extension of three miles has been built to Owasco Lake, ready to open for business when the Summer traffic commences.

The city is peculiarly situated in regard to hills and the road has numerous curves and grades, but no trouble has been experienced in operating any of the lines.

The Thomson-Houston system is used and the equipment consists of six motor cars equipped with two 15 horse-power motors.

More cars are to be added in the Spring and two lines at present run by horse power, will be changed for electricity which, together with extensions in view, will give a mileage of about 10 miles.

The power station and car shed are very conveniently situated in center of line, and adjoining the line of New York Central Railroad, making a cheap and easy manner of coal delivery.

The power station at present is equipped with two 100 horse-power steel tubular boilers.

At present, but one engine is in place, that one being a McIntosh & Seymour compound, of 150 horse-power. Foundations are made for another engine of the same size to be placed in the Spring.

One 80 horse-power Thomson-Houston generator furnishes the power, and the generator room is ready for three more when needed.

The car shed adjoins the engine-house and is of brick, some 90 feet square, and of sufficient size to hold 18 cars. It is equipped with a Hathaway transfer table, and has all appliances for rapid and economical handling of cars while in the house. The company's office is situated on the premises.

Officers of the company are: David B. Gould, president; G. W. Allen, vice-president; Jay E. Storke, treasurer; A. H. Underwood, secretary; G. F. Wells, superintendent.

### Rapid Transit.

Prof. Moses G. Farmer, writing to the New York *Commercial Advertiser*, concludes an article on rapid transit, as follows:

"Any practical scheme of rapid transit to supply prospective requirements must be laid out along the lines of densest travel and must be financially practicable. No river shore lines would do. The congestion is in the aerial lines of travel—along the longitudinal thoroughfares of the island and along the principal cross-town streets, and there is where the people need relief. Of course, a viaduct system through these thoroughfares would be out of the question. It would mean a practical destruction of the streets, and that would be worse than no rapid transit at all. Elevated railroads on the great thoroughfares are not to be considered. They would prove to be the architectural ruin of the city.

"Therefore, I conclude that the only way to solve the difficulty is to build roads in the vast area underground. For a great many years underground travel was talked of, but it met with little favor in public opinion on account of the darkness, the damp atmosphere, saturated with offensive odors of gas, the grease and steam and the terrible noise. But now all these disagreeable elements have been removed by the electric system in use in London. Several months of experiment have proved that it is well-nigh perfect. There is no more comfortable traveling in the world than on the City and South London Railway."

### The Faithful Phonograph.

The now celebrated case of Mary Dusen, a boarding-house keeper of Newark, N. J., against Edward Emonds, a boarder, charged with having placed a phonograph in the kitchen to receive the utterances of Mrs. Dusen when she discussed business in connection with culinary matters, came up before Justice Blauvelt last week. Emonds was charged with a conspiracy to ruin the plaintiff's business, and Mrs. Dusen, who claimed to have only two boarders left, brought suit for satisfaction. The faithful phonograph which had been placed in the kitchen reproduced the observations of the boarding-house keeper in conversation with her cook, and, when placed on the dining-room table, ground out abuse of the defendant. Justice Blauvelt maintained that the phonograph would not lie and dismissed the accused.

## OUR MINNEAPOLIS LETTER.

**The Minnesota State Legislature,** now in session in St. Paul, has under consideration several bills which seem to be especially intended to embarrass the great rapid transit undertaking of the St. Paul and Minneapolis street railway corporation. Two bills are especially antagonistic. One of them provides that passengers shall not be required to pay fares unless they are provided with seats. Circumstances render this bill particularly unjust. Since January 1, 1890, the street railway company has expended more than $2,000,000 in St. Paul and about the same amount in Minneapolis in changing horse car to electrical lines. Further improvements of the same nature, now under way, will cost the corporation $2,000,000 more. It is now on the point of closing the negotiation of $9,000,000 worth of its bonds, and these negotiations, it can readily be seen, must be interrupted by hostile legislation of the character contemplated. It is stated that the bill, however, can be passed in the Senate at any time, and has fair prospects for passage in the House. The street railway company has been straining every energy to complete the equipment of its lines, but as yet the service is necessarily inadequate. Thos. Lowry, president of the company, has appeared before the Senate committee on corporations and explained the situation, but apparently without avail. If the bill becomes a law, it will unquestionably retard the work on the electric lines, and possibly lead to the permanent abandonment of much construction already outlined. The second bill provides for the reduction of fare from five to three cents during those hours of the day when travel is heaviest.

**The Motors** of the St. Paul electric railway system are now running around the "loop," and the service is excellent in all respects, except that there are not enough cars. On the interurban line the time between the two cities is 54 minutes, but this will be reduced to less than 40 within a few weeks when all of the fast motors arrive. The line has more business than it can handle.

**The Minneapolis Board of Trade,** at its session last night, adopted strong resolutions condemning the street car bills before the legislature, setting forth that there was no public necessity nor desire for such measures, and that not only the street railway company but the city itself would be greatly injured if they should become laws. A committee of five, consisting of W. E. Steele, C. C. Taylor, Judge Atwater, J. M. Bartlett and E. J. Phelps, was appointed to wait upon the Hennepin county delegation in the legislature to urge the defeat of the bills. J. C.

Minneapolis, Feb. 9, 1891.

### An Electrical House Warming.

The American Electrical Works will give a "house warming" in its new building, at Providence, Thursday evening of this week. This will be the evening of the last day of the Electric Light Convention, and the many friends of Mr. Eugene Phillips, the popular president of the American Company, will remain to enjoy the pleasant hospitality of his company.

### LITERARY.

"Transactions of the American Institute of Electrical Engineers," for December, 1890, is out. This issue covers the special meeting held November 18, 1890, at which the Standard Wiring Table Committee presented a revised report; a paper on "The Theory of Compound Winding for Constant Potential," was read by Dr. Louis Bell, and a paper on "A New Method of Analyzing Armature Reactions of Alternators," was presented by Mr. Charles Steinmetz.

### McCreary's Thermo Cut-Out.

The McCreary Electrical Specialty Company, 18 Cortlandt street, this city, will put upon the market in about ten days the thermo cut-out shown in the accompanying illustrations. It is designed to be used as a fixture "bug," a coupling for wires run in interior conduits or any similar service. It is the smallest, simplest and best made device of the kind that we have ever seen.

The subject of the illustrations is the No. 1 size, designed to carry from one to three lights. Its exact dimensions are ⅞-inch long and ½-inch diameter. The body is made of hard rubber, into which the holes for the contact screws are counter-sunk. The ends of the conductors run into brass sleeves or ferrules upon which the screws rest. This insures a large electrical contact, the pressure of the screw bringing the whole surface of the brass sleeve into contact with the wire. It will be noticed that the conductors are separated by the maximum amount of insulating medium possible in the device. Open springs on the shanks of the screws keep the fuse wire in contact at all times with the conductors. The fuse wire is sunk in a slot where it is protected from abrasion. As is evident from the cut, there are only two screws in the device. No tape is required in fitting this cut-out, a saving of some magnitude.

FIG. 1.—MCCREARY'S THERMO CUT-OUT.—THREE TIMES ACTUAL SIZE.

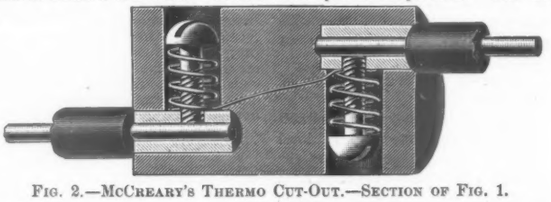


FIG. 2.—MCCREARY'S THERMO CUT-OUT.—SECTION OF FIG. 1.

## OUR SEATTLE LETTER.

**During the Past Year** there has been a period of unexampled activity in the building of street railways in this city. Some 35½ miles of electric railway track have been put into operation. The following table gives an idea of the progress made here:

| | Single track miles. | Double track miles. | Total mileage of track. |
|---|---|---|---|
| IN OPERATION JANUARY 1, 1891. | | | |
| Seattle electric | 2½ | 10 | 22½ |
| Green Lake electric | 4½ | ... | 4½ |
| Rainier avenue electric | 6½ | ... | 6½ |
| West street & North End electric | 3½ | 2½ | 7½ |
| Total | 17 | 12½ | 42 |
| CONSTRUCTED AND PUT IN OPERATION DURING 1890. | | | |
| Front street electric to King street | ... | ¼ | ½ |
| Seattle electric | 14½ | ... | 14½ |
| Green Lake electric | 4½ | ... | 4½ |
| Rainier avenue electric | 6½ | ... | 6½ |
| West street & North End electric | 3½ | 3 | 9½ |
| Total | 29 | 3¼ | 35½ |
| UNDER CONSTRUCTION JANUARY, 1891. | | | |
| Rainier avenue electric, down Washington street | 1 | | |
| Rainier electric (along south shore Lake Union and to Latona) | 4 | | |
| Total | 5 | | |

There are, besides, some two miles of motor and 17½ of cable in operation.

**The Seattle Electric Railway** has just reorganized with a capital of $1,500,000. The original capital was $240,000. In addition to this they have issued bonds for $400,000, and have spent the profits for two years and and a half, about $80,000 in their construction. This makes $720,000 spent on the road. In addition to this, the franchises are extremely valuable. So the $1,500,000 is intended to clear off the bonds and square the company, whose officers believe it can easily pay dividends on $1,500,000. The extension of the lines will add largely to the revenue. During the coming year a good deal money will be spent in improving the equipment.

Seattle, Wash., Jan. 25, 1891. H. L.

### Mechanical Aids to Electric Lighting.

A number of new inventions and improvements for electric lighting purposes, by Mr. Van A. Thomas, superintendent of the Narragansett Electric Lighting Company, are shown in this issue of the REVIEW. These inventions are controlled by E. M. Carhart & Company, of Providence, and are being adopted by the Electric Lighting Company of that city.

The mast arm is simple in construction, strong and durable, made of double L iron, which is used as conductors as well as for the track to carry the lamp out over the street. These tracks with the supporting brace are insulated from the pole, dispensing with the cable, which has always been the source of annoyance. A switch is placed on the pole to switch out the lamp circuit while being trimmed. In the tree insulator the

FIG. 1.—LAMP INSULATOR.—CARHART & COMPANY.

line remains in a normal position, allowing the tree to sway with the wind, as though there was no disturbance. It also prevents the line from coming in contact with the tree or limb.

The carbon holder is an improvement. When the thumb-screw is turned to take out the carbon, it holds the adjustable part of the holder open ready to receive the new carbon. This is done with a small collar on the screw inside of the adjustable part which follows out with the screw, this adjustable part being connected to the main body by a pin hinge, no part being separable.

The insulation for arc lamps, as shown, is designed for commercial lamps. In many cases lamps cannot be hung more than seven or seven and a half feet from the floor or sidewalk. There are many thousands of lights in stores that would have to be taken out were the law regulating the height of lamps to eight and one-half or nine feet enforced and, if in any case they were hung to that height, much of the effect of the light would be destroyed in mills and factories, as

FIG. 2.—TREE INSULATOR OF CARHART & COMPANY.

well as in stores and store windows. This rubber insulation is made to fit any style of lamp and a perfect insulation secured, preventing any disastrous effect if the lamp is taken hold of.

Instead of lamp trimmers being obliged to carry, in addition to the load of carbons, a ladder all day, a socket on either side of the pole is all that is necessary. The trimmer takes two small brass steps, placing one in each of the sockets, as illustrated, goes up the pole, trims the lamp, comes down, takes out his steps, places them in his pocket and goes to the next lamp post, and so on, thereby being able to do a much greater amount of work.

The Carhart cable clip is also shown and is simple in construction, easily adjusted in passing a fixture and very durable, being made of the best galvanized iron.

### Honoring Mr. Hine.

The gentlemen who have been associated for years in the electrical business with Mr. Henry Hine, who recently resigned as district agent of the Westinghouse Company to accept the general management of the Stanley

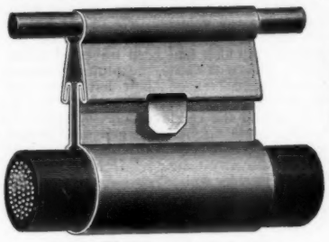


FIG. 3.—CARHART CABLE CLIP.

Electric Manufacturing Company, gave a dinner in his honor at "The Arena," New York, Friday evening of last week. The gentlemen present were: Alexander M. Moffatt, Henry Hine, John N. Noble, Herman W. Grannis, Will. S. Hine, George F. Porter, B. B. Nostrand, Jr., Frank L. Townsend, A. Taylor, E. W. Seymour, R. C. Garbart, E. N. Sanderson and C. A. Bragg.

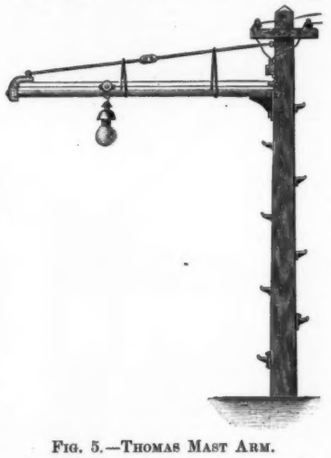


FIG. 5.—THOMAS MAST ARM.

A beautiful diamond pin, in the form of a horseshoe, was given Mr. Hine, and many kind words, expressive of the high esteem in which he was held by all, were spoken. Characteristic telegrams were received from Mr. F. A. Cheney, of Elmira, N. Y., an intimate friend of Mr. Hine's. These were responded to in kind by the diners. Illuminated menus, with the name of each one present embossed, were at the different plates.

Thirteen persons were at the dinner, given on the thirteenth of the month, at "The

FIG. 7.—CARBON HOLDER—OPEN.

Arena" in Thirty-first street, and on Friday. If this event does not bring good luck to every participant, then all these signs, which are supposed to go by contraries, must be looked upon as having lost their potentiality.

—— A corporation is to be formed to supply Millbury, R. I., with water, gas and electricity.

—— Nearly 100 of the members of the department of electricity of the Brooklyn Institute responded to an invitation given by Superintendent William S. Barstow, of the Brooklyn Edison Illuminating Company, to visit the company's station at 360 Pearl street, the evening of February 6.

FIG. 4.—CARHART CABLE CLIP—OPEN.

—— Louisiana, Mo., is all excitement over the action of the city council in making a contract with the gas company of the city for lighting the streets with electric arc lights until midnight only, at a price of $1,500 a year for 20 lights, instead of giving the contract to the Incandescent Light Company for 100 incandescent street lights scattered all over the city, at the price of $1,200 a year for all-night service,

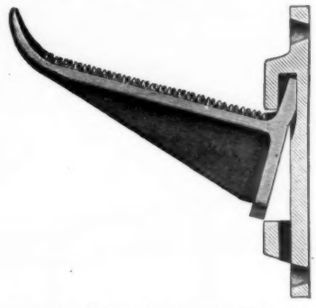


FIG. 6.—POLE STEP BEING PLACED.

—— It is reported that Henry Villard has purchased the interest of Messrs. Charles Ray, C. F. Illsley, J. H. Tweedy, Jr., and others in the Milwaukee Edison Illuminating Company, and that H. C. Payne is now the only Milwaukeean who has any financial interest in it. The company is to go on as at present for a short time, and the present officers will continue to act in their respective capacities, but it is understood that the new company will soon be organized and the old disbanded.

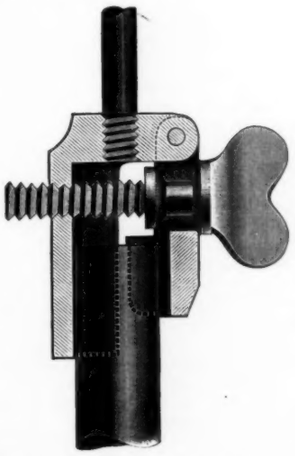


FIG. 8.—CARBON HOLDER AND CARBON.

—— The usually dignified and sedate Chicago *Evening Post* informs us that "About 75 western electricians will go from Chicago to the Providence meeting of the National Electric Light Association, to be held on the 17th, 18th and 19th of this month. Each man will carry with him a storage battery and an electro-plated, double-galvanized, adjustable stomach lining, warranted fire-proof. No clams this time, but there will be gore as usual and a gigantic jag of joy all around the circle."

## ELECTRIC LIGHT NEWS

—— Flatbush, L. I., wants better postal facilities, lower street car fares and electric lights.

—— The electric light company of Portland has petitioned for leave to run its wires underground.

—— Two Rivers, Wis., has been offered a new $50,000 hotel on condition that water works and electric lights are provided for the city between now and Summer.

—— The Gloversville Electric Railway Company has filed articles of association. Formed for constructing an electric railway 3½ miles in length; capital, $40,000.

—— The Dean and Chapter of Durham, England, have just arranged to light their magnificent cathedral by electricity. The river Ware is to supply the motive power.

—— The Detroit Electric Light & Power Company has re-elected its old officers and board of directors, with the addition of W. S. Crane and Ralph Phelps, Jr., as new directors.

—— The Monongahela Electric Light and Power Company, of McKeesport, Pa., has awarded the Edison Company the contract for a $30,000 plant. Ground will be broken immediately.

—— The Perkins Electric Lamp Company's factory at Manchester, Conn., was recently described at length in the *Saturday Herald* of that place. The output is now 4,000 lamps per day.

—— There is a prospect that in the near future a municipal light plant will be in operation in Jamestown, N. Y. The board of public works has awarded the contract for putting in the plant and the common council has ratified it.

—— The Lockport Pulp Company, of Lockport, has made arrangements to put in one of the most complete electric light plants in the State. The contracts with the Thomson-Houston Company are signed, calling for a 250 light dynamo.

—— The village authorities of Newport, N. H., have closed a contract with the Thomson-Houston Company, of Boston, to light the village for five years with 16 electric lights, 1,200 candle-power. The power will be obtained from the falls on Clyde river in Derby, one mile distant.

—— The city council has decided to submit to the people of Ft. Dodge, Ia., at the coming city election, the question whether or not the city shall purchase and operate an electric light plant of its own. The city is at present renting its street lighting from the Thomson-Houston Company.

—— An electric light ordinance granting a franchise to Horace K. Thurber and James A. Taylor, of New York, has passed the Bayonne, N. J., City Council. They are to begin operations within nine months, and to have a plant in working order one year later. Wires are to be strung above ground.

—— Chas. G. Armstrong, who for some time past has been connected with George Cutter, has opened an office at 1302 Auditorium Building, Chicago, and is prepared to do general electrical expert work. He has also been appointed consulting electrician for Adler & Sullivan, the well-known architects.

—— The Fort Wayne Electric Company report the following business done by the Buffalo, N. Y., office since January 1: Niagara Falls, Ontario, 80 arcs; Batavia, N. Y., 120 arcs; Warsaw, N. Y., 60 arcs, 750 alternating; City of Jamestown, 150 arcs; United States Electric Light & Power Company, Buffalo, N. Y., 80 arcs. This is pretty good for six weeks.

### Foreign Patent Sharks.

Messrs. Wm. P. Thompson & Company, agents for European patents, call attention in a circular letter to a system of imposition upon American inventors who are captured by the "cheap" work offered by alleged attorneys, who flood the country with circulars fishing for prey. There are so many shark schemes practiced upon the poor inventor—and it is usually only those who can least afford the loss who are caught—that the only safe plan is to deal with attorneys who are recommended by people you know or who have some other equally reliable endorsement. Beware of the man who wants to sell your patent at a fabulous price, if you will only pay 20 or 30 dollars for advertising expenses. Beware of the man who in a flaming circular offers to do professional work for almost nothing. You can be assured he has some sinister motive in making the proposition, and before you get through with him you will find him dear enough.

The following is quoted from the letter:

We think it right to expose to you the full particulars, as far as we have been able to ascertain them, of an organized system by which, on an average, at least 20 American patentees per week are grossly victimized. Certain individuals in this country who have lately got themselves registered as patent agents, have circulars sent round from places in New York or Washington, usually in the name of some high-sounding "Company." These circulars are sent to every patentee the moment his name appears in the Official Gazette of the United States Patent Office, offering to procure European patents for them at what they please to term cost price, or seemingly without any profit to themselves, and afterwards to negotiate the sale of such patents. They also sometimes publish statements of the number of companies which they make appear to have floated for purchasing patents, whereas we do not believe that one solitary individual has ever received a penny from them by the sale of his patent. We have letters from patentees in America complaining that they have sent $20 for provisional protection to some of those gentry, but have never got a reply or acknowledgment of any kind whatever. The French patents, if applied for by them at all, are, of course, in every instance, absolutely null and void, owing to the prior publication of the United States patents in America. The German patents, if applied for at all, are refused for a similar reason. The English patents are at least nine times out of ten null and void, owing to sufficient information having been set forth in the United States Gazette to enable a person to work the invention. As, too, the provisional specifications of these patents are simply copied from the Gazette already published in Great Britain, it is very doubtful whether *in any case* the patents can be upheld, as it is certain that everything contained in the provisional specification had fallen into the public domain before the date of application.

These bogus companies, of course, hand the patents over to the individuals who are really the company, stating that they have put the patent into the hands of a high-class firm of English patent agents. Now, if this system is to continue, in a very short time two results will follow: (1) Every patentee who has paid a reasonable fee for a patent to his American patent agent, on getting these circulars, not knowing the actual facts of the case, will at once consider that he has been imposed upon by his American patent agent. (2) As the inventors in all these bogus cases will have simply lost their money without any return whatsoever, in a short time European patents will be looked upon as nothing but sinks in which all money invested in them is lost. The success of these men shows also that American patent agents do not sufficiently explain to their clients the value of European patents, otherwise the clients would have taken out the patent through their own agents, and in proper time, instead of falling into the hands of these harpies.

### Change of Ownership.

The change in ownership in the Merrimac Valley Street Railway, at Lawrence, Mass., has come to pass, and the road goes into the hands of New York capitalists. Of the 800 shares of stock, 760 have been sold. The price paid was $250 per share. As the old company bought the stock last Summer at $150 per share, it makes a handsome profit —$100 on each share, or $76,000 on the whole transaction.

The new owners are William A. Perrin and J. N. Beckley, both of Rochester, N. Y. Albert D. Bosson, of Chelsea, and Nathan E. Morton, of Lawrence, retire from the board of directors, and the New Yorkers take their places. President Ferguson, of Salem, will retain his position, while Albert E. Butler, of Lawrence, will remain as treasurer. E. P. Shaw, of Newburyport, remains on the board of directors.

CAPT. W. L. CANDEE, MANAGER, OKONITE COMPANY.

The railroad commissioners will be asked shortly to authorize the increasing of the capital stock of the road from $80,000 to $300,000. Then electricity will be put in and a line will be built to Andover. All the improvements contemplated by the old company will be carried out by the new owners.

OKONITE COMPANY.—MR. MANSON'S OFFICE.

### Sad Result of Mixing Telegrams.

Assemblyman Joseph Fitch, of Queens county, will shortly institute a suit for $25,000 damages against the Western Union Telegraph Company for one of the most unhappy blunders ever made by that corporation. By reason of this error, Mrs. Fitch has been thrown into a state of nervous prostration bordering upon insanity, and her husband is now detained almost constantly at her bedside.

On Tuesday afternoon, at 3:45 o'clock, Mr. Fitch went to the Western Union telegraph office at 195 Broadway, and sent the following message:

Mrs. Joseph Fitch, No. 236 Lincoln street, Flushing, L. I.: Won't be home until 8 o'clock. Am detained by Getty Square business. JOSEPH FITCH.

At 4:40 a Western Union telegraph messenger rang the door bell and handed her the following telegram:

Mrs. Joseph Fitch, No. 236 Lincoln street, Flushing, L. I.: Your sister lies dead at the morgue. What shall I do? MRS. GARRITY.

Mrs. Fitch was found shortly after lying senseless on the floor, with the telegram clutched tightly in her hand. She soon recovered, however, and at once began preparations for an immediate journey to New York. The haste with which she ran about from room to room amounted almost to feverish delirium.

At 6:10 the messenger boy again rang the door bell. "They sent me for that message," he said; "it wasn't for you at all. Here's yours," at the same time handing her Mr. Fitch's telegram.

### Electricity to Stop Runaway Horses.

A dispatch from Chicago to the New York *Sun* reads as follows:

A carriage drawn by a pair of spirited horses that dashed north on St. Clair street yesterday afternoon at a furious gallop, made a number of pedestrians halt, in anxiety for the welfare of the one passenger who sat in the vehicle. No driver was on the box, and the lines hung slack on the horses. A block had been traversed when, for no apparent cause, the plunging horses threw themselves on their haunches, and came to a sudden standstill. The man inside opened the carriage door, stepped out, with a smile on his face, and said to a reporter who had been watching the progress of the runaway team: "Don't you think it works pretty well?"

It was a livery man who says he has invented a "press-the-button" electrical contrivance by which a runaway team may be stopped instanter. Beneath the driver's box a two volt dry battery is placed, in the top of which are inserted three copper pegs that project from the ends of the lines. Running inside the lines are copper wires forming a circuit through the horses' noses by small polished balls of aluminum which press lightly against the inner sides of the nostrils. The circuit is opened and closed by means of two buttons, one of which can be operated by the driver. Should he be thrown from his seat before he can press the button, another button beneath the seat inside the carriage can be operated by the occupants.

A reporter tested the merit of the invention by pressing the button inside the carriage after the horses had been allowed to quicken their pace to a run. It apparently worked like a charm. Similar tests on North Park Boulevard drew a large crowd, and the success attending the exhibition drew much applause from the spectators. In addition to his device for stopping runaway teams, Mr. Holson has also patented an electrical stimulator for starting lazy or balky horses, and giving them "style." This device is operated through the lines also, the current being applied to the horses' sides by copper plates in the back band.

### Mayor and President.

Mayor Fifield was re-elected president of the Middlesex Electric Light Company yesterday. It was thought that he would resign that position when he was elected mayor. Failing to do that immediately, there seemed to be excuse in the fact that the annual meeting of the company coming so soon, he might deem resignation unnecessary. But it appears that such excuse will not cover his negligence. He is again the president of a company with which the city contracts for light. This is very apparently in violation of the city ordinances to which all city officials are supposed to conform, and the question will now naturally rise, how can he enforce the very ordinance which he appears to have himself violated.—*Lowell, Mass., Mail.*

### Poles in New York.

Alderman Brown offered a resolution in the Board of Aldermen, last week, providing an amendment to an ordinance which will make it unlawful for any person to erect a pole or post in front of any residence for carrying electric wires. All poles are to be painted brown, except the fire poles, which will continue to be painted red. The poles shall bear the name of the company owning them. The resolution was referred to the Law Committee.

### New Offices of a Big Wire Company.

The REVIEW does not generally devote much space to illustrating individuals and private offices, but we think the photographs on this page will present so fine a looking staff that our readers will enjoy the illustration. The leading lights of the New York end of the International Okonite Company (Limited), New York and London, are

GEO. T. MANSON, OKONITE COMPANY.

the gentlemen whose portraits are here given. Capt. Willard L. Candee is well known socially in Brooklyn, where he holds the captaincy of Company B in the crack Twenty-third regiment. He has been connected with the International Okonite Company since its start, and to his efforts is due largely the proud position occupied by this concern among American manufacturers today. Mr. H. Durant Cheever with Captain Candee conducts the business management of the International Okonite Company in America. Mr. Cheever is a graduate of Harvard, and became associated with the company in July, 1888, directly after completing his course at college. He is a thorough business man, bright and progressive, and has a prominent business career before him. Mr. George T. Manson is probably one of the best known men in the electrical field. He has been connected with the International Okonite Company five years, and he co-operates with Messrs. Candee and Cheever in the business management of the concern. Mr. Manson was previously interested for many years in the New England Telephone & Telegraph Company, of Boston, Mass. He has a host of friends in the electrical field. Mr. F. Cazenove Jones, general manager of the company's factories at Passaic, N. J., and who is a descendant of Capt. John Paul Jones, has been connected with

F. CAZENOVE JONES, SUPT., OKONITE FACTORIES.

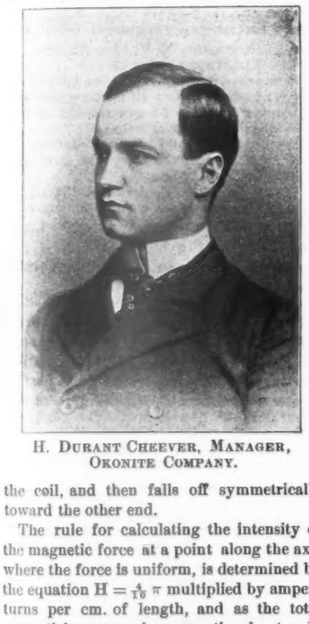
the International Okonite Company for many years, and his thorough knowledge of mechanics fits him specially for the important position he occupies. We also present views of the private offices of Messrs. Candee, Manson and Cheever, in the International Okonite Company's new quarters, 13 Park Row, New York. The furnishings in all are very complete and artistic, and nothing seems wanting for the convenience and comfort of the gentlemen who occupy them.

## Properties of Solenoids.

ABSTRACT OF A CANTOR LECTURE BY PROFESSOR SILVANUS P. THOMPSON.

If you take a long steel magnet with the south pole five or six feet away and the north pole at a point three diameters distant from the mouth of the coil, the pull exerted by one spiral on the north pole would be practically less than two per cent. of the amount when the pull was pushed right up to the coil. But in any given coil the action of all the turns of wire must be considered. In such a case the action is the same as if the turns were gathered together in small numbers at distant intervals. If, instead of having four wires distributed over a centimetre, you have one stout wire in the middle of that space carrying four times the current, the general effect is the same.

A curve constructed in accordance with the attractive effort at different points of approach to and into the coil, starting at a point about two and one-half diameters away from the end, first rises gently, then suddenly, and then falls and becomes nearly flat with a long level back; for example, a tubular coil one inch in diameter and 20 inches long will have a uniform magnetic field for about 15 inches along the middle of the coil, which means that the value of the magnetic forces along the axes of the coils begins outside of the mouth, rises to a maximum amount a little within the mouth, is then perfectly constant nearly all the length of



H. DURANT CHEEVER, MANAGER, OKONITE COMPANY.

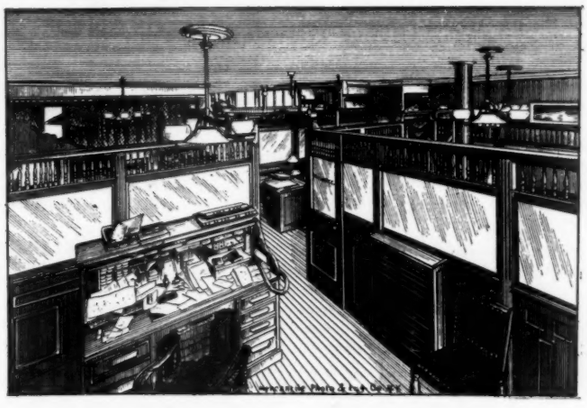
the coil, and then falls off symmetrically toward the other end.

The rule for calculating the intensity of the magnetic force at a point along the axis where the force is uniform, is determined by the equation $H = \frac{4}{10}\pi$ multiplied by ampere turns per cm. of length, and as the total magnetizing power is proportional not only to the intensity of the magnetic force at any point, but also to the length, the integral magnetizing effect on a piece of iron inserted in the coil may be taken as practically equal to $\frac{4}{10}\pi$ multiplied by total number of ampere turns in that portion of the tubular coil which surrounds the iron. If the iron protrudes as much as three diameters at both ends the total magnetizing force is simply $\frac{4}{10}\pi$ multiplied by whole number of ampere turns.

Now, the case we have supposed of a steel magnet with unalterable poles is not the kind we usually have to deal with, as the hardest steel magnet when brought up to the end of a magnetizing coil has its magnetism affected thereby. We usually have to deal with soft iron plungers which are not magnetized at all when at a distance away, but become magnetized in the act of being placed at the mouth of the coil, and become more highly magnetized the farther they go in. They tend to settle down with the ends protruding equally, for that is the position where they most nearly complete the magnetic circuit, and where, therefore, they are most highly magnetized. Suppose we are using a very long core, so that when the front pole has entered the coil the other end is a long way off. When the core has entered up to a certain point you have all the magnetizing forces up to that point acting on it. It acquires a certain amount of magnetism so that the pull will necessarily go on increasing, although the intensity of the magnetic force from point to point along the axis of the coil remains the same until within about two diameters of the far end. Although the magnetic force inside the long spiral remains the same, the pull goes on increasing, if the iron does not get saturated, at an almost uniform rate until the piece of iron has been poked pretty nearly through to the distant end. In the case of the plunger of the same length as the coil, as soon as the core has entered about half or a little more than half its length, the action of the protruding pole begins to be asserted, tending to pull the plunger back, and although the magnetizing force goes on increasing the farther the plunger enters the repulsion exerted by the coil on the other pole of the plunger also increases, so that the maximum magnetizing force occurs at a point a little farther than half way along the coil, and from that point the curve of magnetization gradually descends to zero at the end of the coil; that is to say, when both ends of the plunger coincide with the ends of the coil, there will be no pull. If you take a plunger that is a little shorter than the coil, the attraction reaches zero at an earlier period still, and the maximum pull also occurs earlier. The only case in which the maximum pull occurs when the plunger is half way in, which is the rule indiscriminately laid down in the books, is when the plunger is of the same length as the coil, for when it is longer the maximum pull occurs when the lower end gets to the bottom; and with a very short core the maximum pull occurs as it enters the mouth of the coil, and when it has entered far enough for both ends to be within the regions of equable magnetic field there is no more pull at one end than at the other. One end is trying to move with a certain force down the tube and the other is trying to move with exactly equal force up the tube, the two thus balancing one another, and if the core be made into a little round ball of iron you will find the curious result that the only place where any pull occurs is just as it is going in at the mouth of the coil and for about half an inch in the neck of the coil, but there is no pull down the interior of the coil and no measurable pull outside.

In order to ascertain the amount of work done by a coil, the amount of force at each point must be multiplied by the distance through which its point of application moves. If we call the length of travel $x$, the element of length, that is, the short distance through which the force at any given point may be considered to act, must be called $dx$, and that multiplied by the force $f$ must give us the work $dw$ done in that short range; now, the whole work over the whole travel is made up of the sum of such elements added together, that is to say, we have to take all the various values of $f$ and multiply each by its own short range $dx$ in order to get the total amount of work. If we compare such an amount of work with that performed by an electro-magnet, which instead of giving a distributed pull gives a much stronger pull over a shorter range, we will find that the amount of work performed in both cases is the same. The electro-magnet beginning with a gentle attraction soon runs up and draws the force curve to a tremendously steep peak, becoming a very great force when the opening in the magnetic circuit is very small. This may be illustrated by providing the coil with a core made in two parts. Inserting one part in the core it will be attracted in a similar fashion to the bar of double the length, but being a little shorter the maximum would be displaced. Let it be drawn up to half way only—we now have a tube half filled with iron and in doing so we shall have had a certain amount of work done by the apparatus. As the piece of iron is shorter the force curve will lie a little lower than the force curve of the longer bar, the area of the force curve will be the work done by the attraction of the core. Now, putting the other half into the coil, we get not only the attraction of the coil but that of the section of core already in acting like an electro-magnet; beginning with a gentle attraction it rises very suddenly to the sharp peak mentioned above and becomes a very great force when the distance from the other section is very small. We have, therefore, in this case a very different curve from the other, but the net result of the two curves for the half sections of the core, that is to say, the total amount of work done is the same as in the case with the long core. Whether you allow the plunger to come in by a gentle pull over a long range or whether it be put in in two pieces, one part with a gentle pull and the other with a sudden spring up at the end, the total area of the two curves must be the same.

The advantage then of the coil and plunger method of employing iron and copper is not that it gets any more work out of the same expenditure of energy, but that it distributes the pull over a considerable range.



OKONITE COMPANY.—CAPT. CANDEE'S OFFICE.

OKONITE COMPANY.—MR. CHEEVER'S OFFICE.

## The Patent Celebration.

The preliminary programme of the celebration of the beginning of the second century of the American Patent System by inventors and manufacturers of patented inventions, has been issued by the executive committee. Anniversary day will be celebrated by a trip to Mount Vernon, where Dr. J. M. Toner will talk upon "Washington as an Inventor and Promoter of Improvements." No one living is probably better fitted for this task than Dr. Toner. For many years he has gathered every scrap of history relating to Washington. A series of public meetings will be held, afternoon and evening, on April 8, 9 and 10, which will be presided over by the President of the United States, the Secretary of the Interior, President of the National Board of Trade, Secretary of the Smithsonian Institute and Prof. A. Graham Bell. Addresses upon the following subjects are promised at the public meetings by the distinguished gentlemen mentioned:

Edward Atkinson, Ph. D., LL. D., of Massachusetts.—Invention in its Effects upon Household Economy.

Dr. John S. Billings, Curator, U. S. Army Medical Museum.—American Invention and Discoveries in Medicine, Surgery and Practical Sanitation.

Hon. Samuel Blatchford, Justice of the Supreme Court of the United States.—A Century of Patent Law.

Cyrus F. Brackett, M. D., LL. D., of New Jersey, Henry Professor of Physics, College of New Jersey, Princeton.—The Effect of Invention upon the Progress of Electrical Science.

Hon. Benjamin Butterworth, of Ohio, U. S. House of Representatives.—The Effect of our Patent System on the Material Development of the United States.

Octave Chanute, of Illinois, President of the American Society of Civil Engineers.—The Effect of Invention upon the Railroad and other means of Inter-Communication.

Professor F. W. Clark, S. B., of Ohio, Chief Chemist U. S. Geological Survey.—The Relations of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics.

Hon. John W. Daniel, of Virginia, U. S. Senator.—The New South as an Outgrowth of Invention and the American Patent Law.

Major Clarence E. Dutton, Ordinance Department, U. S. A.—The Influence of Invention upon the Implements and Munitions of Modern Warfare.

Thomas Gray, C. E., B. Sc., F. R. S. E., of Indiana, Professor of Dynamic Engineering, Rose Polytechnic Institute, Terre Haute.—The Inventors of the Telegraph and Telephone.

Professor Otis T. Mason, Ph. D., of Virginia, Curator, U. S. National Museum.—The Birth of Invention.

Hon. Charles Eliot Mitchell, of Connecticut, Commissioner of Patents.—The Birth and Growth of the American Patent System.

Hon. O. H. Platt, LL. D., of Connecticut, U. S. Senator.—Invention and Advancement.

Col. F. A. Seely, of Pennsylvania, Principal Examiner U. S. Patent Office.—International Protection of Industrial Property.

Hon. A. R. Spofford, LL. D., Librarian U. S. Congress.—The Copyright System of the United States; its Origin and its Growth.

Hon. Robert S. Taylor, of Indiana.—The Epoch Making Inventions of America.

Robert H. Thurston, A. M., LL. D., Doc. Eng., of New York, Director and Professor of Mechanical Engineering, Sibley College, Cornell University.—The Inventors of the Steam Engine.

William P. Trowbridge, Ph. D., LL. D., of New York, Professor of Engineering School of Mines, Columbia College.—The Effect of Technological Schools upon the Progress of Invention.

Hon. Edwin Willits, of Michigan, Assistant Secretary of Agriculture.—The Relation of Invention to Agriculture.

Hon. Carroll D. Wright, M. A., of Washington, Commissioner of Labor.—The Relation of Invention to Labor.

Every inventor and every one directly interested in patented inventions, should, if possible, attend these proceedings. Washington is a charming place in April, and a few days relaxation will do everyone good. Aside from the intellectual entertainment promised, the business end of the convention may, if a proper interest is manifested, result in great advantage to those interested in patents. It is proposed to organize a national association of inventors and manufacturers, which can make itself felt in the inventor's interest, and can, perhaps, put a few bent pins upon the chairs at Capitol Hill and rouse Congress from its coma on the patent question.

## More Appeals.

In the First Division Court of Appeals, at Albany, N. Y., recently, the cases of two murderers sentenced to electrocution were argued. Slocum, the ball player, and Trezza, the Italian, argued against their sentences on the strength of the success which has attended Jugiro, the Japanese, in his efforts to stay his fate. It is the opinion of Attorney-General Tabor that the government should hasten to pass the bill correcting evidence in these cases.

Two 100-volt 16 candle-power incandescent electric lamps of the Sawyer-Man system, which were placed in a paper mill in Camden, N. J., in July, 1887, and which have been burning on an average of 14 hours daily, are said to be still giving good light.

**The New York Engraving Company,** 320 to 322 Pearl street, have sent us a very beautiful 12-leaf calendar.

**Crosby Steam Gage and Valve Company,** of Boston, have received an order which calls for the equipment of farm engines with 500 steam engine pop valves for a prominent Western firm, and an order from a California house for 50 single bell chime whistles.

**The Direct U. S. Cable Company** is sending out yellow leaflets, about the size of a cable blank, on which is printed a large "query mark" and the following: "Would you have had a healthy competition and a speedy and accurate service, if it had not been for the 'Direct Company.'"

**Stanley & Hall.**—A special meeting of the stockholders of Stanley & Hall, manufacturers of electrical household goods, will be held at the office of the company, 32 and 34 Frankfort street, New York, February 26, 1891, to determine whether the capital stock of the company shall be increased from $20,000 to $30,000.

**The Weston Electrical Instrument Company,** of Newark, N. J., will be represented at the Electric Light Convention as usual, and probably show a line of their Standard portable direct-reading voltmeters and ammeters. These goods are very popular, and the manufacturers have been kept very busy of late.

**The Empire China Works,** 144-156 Greene street, Greenpoint, Brooklyn, N. Y., are sending out a new illustrated price-list of hard porcelain electrical supplies. They make anything electrical in hard porcelain that can be made of that excellent material. A porcelain "pigtail" is very appropriately marked "No. Q" in the catalogue.

**Fire Felt,** the new non-conducting pipe and boiler covering, made by the Chalmers-Spence Company, 59 and 61 Liberty street, New York, is a flexible felt made entirely of asbestos. It is unrivalled for the purpose intended, and is becoming very much in demand. The Chalmers-Spence Company manufacture a large line of asbestos specialties.

**The best of manufacturing and electrical supplies** of all kinds can be found in the warerooms of H. A. Rogers, 19 John street. Mr. Rogers is the sole United States agent for the J. Moncrieff celebrated Scotch gauge glasses, which are undoubtedly the best manufactured anywhere in the world, and have an immense sale in this country.

**The Page Belting Company,** Concord, N. H., have opened a branch house at 16 Dey street, New York City, where all their well known brands of belting will be kept in stock and disposed of at factory prices. Mr. G. A. Pierce is the manager of the New York office, and will be glad to show his wares to any one who will call at the new store.

**The Mather Electric Company,** of Manchester, Conn., were awarded the highest award, a gold medal, at the Mechanics' Fair in Boston. The company contracted to light the building, but never considered that the contract was an official exhibit, but simply a business transaction. The managers of the Fair hold, however, that everything shown in the building was an exhibit.

**The Cleverly Electrical Works,** Philadelphia, have sent us a thermometer 21 inches long and 5¼ inches wide, made of varnished poplar. The tube is of glass and contains a purple fluid which looks like copying ink. A brass cage around the bulb is designed to keep it from getting away. The top of the tube is braced so that the beautiful fluid can't get out there. We guess the fluid is safe.

**George Cutter** has been filling a number of orders for his street-hoods, all of which are fitted with his improved snap hinge. This allows them to be shipped in pieces and to be readily put together without the use of solder or even of a screw-driver. They are so shaped as to give an even distribution of light, and thoroughly protect the socket from the weather. They are now made at George Cutter's new shop at Chicago.

**The Berlin Iron Bridge Company,** of East Berlin, Conn., have just erected a new iron roof for the New Rochelle Gas & Fuel Company, to take the place of one lately destroyed by fire. The roof is composed entirely of iron so that there will be no further danger from fire. The Gas Company have suffered considerable loss and damage from the loss of their roof and now propose to have something so that there will be no danger from fire.

**Greene, Tweed & Company,** 83 Chambers street, New York, are the sole agents of the Western Carolina Mica Company, recently organized to develop over 20,000 acres of fine mica land in North Carolina, which they control. The mines are in charge of J. K. Irby and R. L. Rorison, who have had an experience of 15 years in this business. Greene, Tweed & Company will soon have considerable mica of fine quality to offer for sale.

**The Root New Water Tube Steam Boiler** is simple in construction, sectional and easily erected. The manufacturers, Messrs. Abendroth and Root Manufacturing Company, 28 Cliff street, New York, have placed a large number of them in the leading electric light and power stations of the country. They seem especially suitable for electric light plants, safety from explosion being one of their most attractive characteristics.

**The Electrical Forging Company,** 194 Washington street, Boston, have sent us a handsome steel-engraved prospectus of the company. It is capitalized at $2,000,000 under the laws of Maine, and is officered as follows: Geo. D. Burton, president; Chester Marr, treasurer; Fred. J. Hutchinson, secretary; Gen. Benj. F. Butler, counsel. The company is making electrical forging machines under patents granted to Geo. D. Burton, the president.

**The Toronto Construction and Electrical Supply Company,** 63 to 69 Front street, West, Toronto, Canada, is the name of a new firm. It is the first large electrical supply company established in Canada. The offices and salesrooms are located in what is known as the Permanent Exhibition Building, where unusual facilities for displaying goods are afforded. Mr. Frederic Nicholls is second vice-president and general manager of the new company. They have a good field and we wish them every success.

**The Billings & Spencer Company,** Hartford, Conn., make this statement: "Our business for the past year has been all we anticipated. Our output has been about 25 per cent. more than that of the year 1889. To keep pace with the demand for our goods, we have been obliged to make an extension to our forging department of 186x40 feet. The demand for our Billings' patent commutator bars and copper, bronze, iron and steel drop forgings for dynamos and motors and other electrical goods, shows conclusively that the electrical business has not yet reached its limit."

**The Joseph Dixon Crucible Company,** Jersey City, N. J., have made for years the brand of lead pencils with which these lines are written. The pencils are good. And now this company makes graphite paint for iron work of all kinds, and a belt dressing to prevent slipping and preserve the leather. As it is probable that the paint and dressing contain at least one of the component elements of the pencils, it follows that they must be good in the ratio of that one element to the other elements. The quality of the pencils is so high that the paint and dressing must be of a high order of excellence.

This is the way the outside of a can of Dixon's belt dressing looks. See what it says on the label. Electric light and power men use it extensively and like it. He who does not use it is like the label on the can—not in it.

**Queen & Company, of Philadelphia,** inform us that their exhibit at the Providence meeting of the National Electric Light Association promises to be most interesting. They will show a full line of their special instruments, and also a series of their new magnetic vane ammeters, which are specially intended for central station use. Regarding these ammeters, the Brush Electric Illuminating Company, of New York, say, in a recent letter: "We very cheerfully state that your ammeters, as used by us, have worked accurately and given most excellent satisfaction." Queen & Company have just completed negotiations with Professors Bristol and Geyer, of Hoboken, N. J., for the control of their patent which covers a new form of recording ammeter. These instruments are not yet perfected, but they promise well, and there is certainly a great demand for a reliable recording meter. E. G. Willyoung expects to look after the interests of the firm at Providence, and will be pleased to receive a call from those in attendance and their friends. The exhibit will be in a most prominent position.

**The National Pipe Bending Company,** New Haven, Conn., manufacturers of the National Feed-Water heater, report a large increase in their business of the last three months over that of the previous year. During this time they have sold 194 heaters, including one 300 h. p. to Washington, Pa.; 200 h. p. to Rosendale, N. Y.; 100 h. p. to Providence, R. I.; 200 h. p. to Middlebury Electric Light & Power Company, Middlebury, Mass.; 1,000 h. p. to Lowell Electric Light Company, Lowell, Mass., 100 h. p. to Denver, Col.; 500 h. p. to New York city; 200 h. p. to Danbury, Conn.; 150 h. p. to Greenwood, S. C.; 200 h. p. to Elmira, N. Y.; 400 h. p. to St. Johns City Railway Company, St. Johns, N. B.; 100 h. p. to Aviles, Spain; 500 h. p. to West End Street Railway, Boston; 100 h. p., Butte, Mont.; 100 h. p. to Jamaica, L. I.; 900 h. p. to Thomson-Houston Electric Light Company, Omaha, Neb.; 200 h. p. to Newburyport Electric Light Company, Newburyport, Mass.; 100 h. p. to Brooklyn, N. Y.; 150 h. p. to Baltimore, Md.; 500 h. p. to Tyrone, Pa.; 300 h. p. to Brush Electric Light & Power Company, Savannah, Ga.; 50 h. p. to Ghent, Belgium; 200 h. p. to Montreal, Canada; 800 h. p. to East River Electric Company, New York city; 100 h. p. to Killingly, Conn.; 150 h. p. to Eastchester Electric Light Company, Mt. Vernon, N. Y.; 200 h. p. to Providence, R. I.; 125 h. p. to Burlington, N. C.; 500 h. p. to South Philadelphia, Pa.; 100 h. p. to Edison Illuminating Company, Hackensack, N. J.; 800 h. p. to Johnson City, Tenn.; 300 h. p. to Morgantown, W. Va.; 300 h. p. to Summerfield, Pa.; 300 h. p. to State Line, Pa.; 300 h. p. to Knepper, Pa.; 300 h. p. to Newark, N. J.; 150 h. p. to Marquette, Mich.; 100 h. p. to Indianapolis, Ind.; 150 h. p. to Greenwich, Conn.; 500 h. p. to Edison Illuminating Company, Newport, R. I.; 100 h. p. to Pittsburgh, Pa.; 400 h. p. to Weymouth Electric Light Company, East Weymouth, Mass.; 150 h. p. to Branford, Conn.; 300 h. p. to Wallingford, Conn.; 200 h. p. to Van Ness, N. Y.; 500 h. p. to Memphis Electric Light & Power Company, Memphis, Tenn.; 100 h. p. to Birmingham, Conn.; 150 h. p. to Willmington, N. C.; 300 h. p. to Terryville, Conn., 1,200 h. p. to New Bedford, Mass. This company has also placed a large number of smaller heaters in isolated plants, particularly in manufacturies and large buildings.

### The Crosby Batteries.

We are pleased to publish the following letters endorsing the batteries manufactured by the Crosby Company, of this city:

FROM NEW HAVEN FIRE DEPARTMENT.

CROSBY ELECTRIC COMPANY, N. Y.

*Gentlemen.*—In answer to your enquiry of the 22d, I would say that on November 22, 1890, I set up 20 cells of your Hussey Blue Stone Battery on No. 4 fire alarm circuit. Immediately on setting up with pure water, the 20 cells gave $1\frac{5}{6}$ ampere and 23 volts. Up to this time the battery has remained constant, a daily record has been kept of the galvanometer deflection (Gameville standard), and this galvanometer was rated when the test was begun. I consider your form of battery a great improvement over any form of blue stone battery I have yet seen, its points of advantage being economy in consumption of sulphate of copper and zinc. The ease with which it is set up and put into circuit immediately (when set up) without the use of sulphuric acid or other exciting agents, alone recommends it, as with your batteries it would not be necessary for us to maintain a spare battery.

W. C. SMITH,
Supt. Fire and Police Tel.

FROM AMERICAN DISTRICT TELEGRAPH COMPANY, NEW YORK.

CROSBY ELECTRIC COMPANY.

*Gentlemen.*—The Hussey Blue Stone Batteries which I received from you, have been in constant use since they were first set up, several weeks ago, and have given perfect satisfaction. The work performed by them has been excessive and they have required no attention whatever, not even an ordinary cleaning of the zinc.

Yours respectfully,
C. S. SHRIVER.

FROM WESTCHESTER TELEPHONE COMPANY.

YONKERS, N. Y., Jan. 22, 1891.

CROSBY ELECTRIC COMPANY.

*Gentlemen*—Would say that we have used 50 cells of your Hussey Blue Stone Battery—replacing 70 cells of gravity—on a fire alarm circuit for four months.

They are cleaner and more satisfactory in every way than any battery we have yet used. Very truly yours,

R. E. ALEXANDER,
Assistant General Manager.

Visitors who attend the Electric Light Convention, at Providence, will have the privilege of seeing a full line of the Crosby goods exhibited there.

**The International Okonite Company, Limited,** New York and London, will probably have an exhibit of their Okonite insulated wires and cables, Candee aerial wire and Manson and Okonite tape at the Electric Light Convention. The company will be represented by Capt. Willard L. Candee, George T. Manson, H. Durant Cheever and T. McCoubray.

**Chas. A. Schieren & Company,** 45 to 51 Ferry street, New York, seem to have received about as large a number of orders for belts beyond the ordinary sizes as any firm we know of. They have special facilities for large work, and no order is too big for them to fill. Their perforated electric leather belting still holds its high place in the estimation of electric lighting and power men.

**The Edison General Electric Company,** New York, have issued a neat little hand-book of electric percussion drills, describing in detail the drill known as the Marvin. Those who have used the Marvin pronounce it a marvel. The great advantages of the electric current over compressed air in mining operations are already well known. The Marvin utilizes the current to the best advantage.

**The Moore Electrical Manufacturing Company,** 106 to 108 Liberty street, this city, is the title of the new firm which will conduct the electrical supply business formerly carried on by Moore Bros. at the above address. The officers of the company are: John L. Moore, president; Erastus D. Moore, treasurer; James H. Bates, secretary. The company will manufacture and handle electrical supplies.

**The A. W. Harris Oil Company,** of Providence, R. I., manufacturers of the well-known A. W. Harris brands of valve, engine and dynamo oils, desire to call the attention of delegates to the Providence convention to the importance of using proper lubricants for engines and dynamos, and would refer those interested to the plants of the Narragansett Electric Light and American Electrical Works, where they will find these oils in use, which should be a guarantee of their superior quality.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 10, 1891.

445,969 Electric insulator; James R. Branch, Richmond, Va.

445,991 Electro-mechanical indicator for fire alarm telegraphs; Thos. F. Gaynor, Louisville, Ky., assignor to the Gaynor Electric Co., same place.

446,030 System of electrical distribution for mines; Elmer A. Sperry, Chicago, Ill., assignor to the Sperry Electric Mining Machine Co., same place.

446,031 Electric switch; Elmer A. Sperry, Chicago, Ill.

446,037 Extensible bracket for electric lamps; Jonah E. Titus, Orange, Mass.

446,092 Dynamo-electric machine and electric motor; Edward K. Brown, Brooklyn, N. Y., assignor, by direct and mesne assignments, to himself and Geo. Phillips, same place.

446,104 Electrode for secondary batteries; Marmaduke M. M. Slattery, Fort Wayne, Ind., assignor to the Fort Wayne Electric Light Co., same place.

446,108 Electric arc lamp. 446,109 Arc light; Richard H. Mather, Windsor, Conn.

446,142 Electric signal and search-light lantern; Geo. W. Martin, Somerville, Mass., assignor of one-half to Josiah Knight, same place.

446,159 Switch and signal apparatus; Geo. Westinghouse, Jr., and Jens G. Schrender, Pittsburgh, Pa.

446,174 Electric cooking apparatus; Jeremiah O'Meara, New York, N. Y.

446,180 Insulating coupling block and cut-out; Sigmund Bergmann and Chas. J. Klein, New York, N. Y., said Klein assignor to said Bergmann.

446,188 Telephone transmission: James W. McDonough, New York, N. Y.

446,199 Multiple call box; Frank B. Wood, New York, N. Y., assignor to the Brewer & Smith Visual Signal Co., New Haven, Conn.

446,200 Fire indicator and extinguishing system; Stephen Broichgans, Milwaukee, Wis.

446,214 Method of laying electric cables; Chas. H. Wilson, Chicago, Ill.

446,229 Regulator for electric motors; Lander S. Harris, Detroit, Mich.

446,245 Electric locomotive; Geo. R. Baldwin, Montreal, Canada.

446,284 Automatic potential regulator for electric currents; Alvirus Lonzo Ellis, Kansas City, Mo.

446,297 Electric arc lamp. 446,298 Arc light system; Carl J. Schwarze, Brooklyn, N. Y.

446,313 Electric signal system for railroads; Edgar C. Wiley, Bristol, Tenn.

446,376 Electric railway and contact device therefor; Edw. M. Bentley, New York, N. Y.

446,403 Track instrument for railway signals; Mahlon S. Conly, Chicago, Ill.


YOU make a mistake if you don't buy ELECTRICAL SUPPLIES from F. and F., Cleveland, Ohio.
SEND FOR THE LATEST "LIST of BARGAINS FOR BELL HANGERS" AND "ROCK BOTTOM" ON MEDICAL BATTERIES.
WE UNDERSELL ALL.
ADDRESS,
Fletcher & Fletcher Electric Co., Cleveland, Ohio.
Mention this paper if you want bottom prices.

THE LAW
Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.
Weigh carefully these advantages.

Its sale has steadily increased for ten years.

LAW TELEPHONE CO.,
Sole Makers,
87 JOHN STREET, NEW YORK.

IF YOU GO TO THE
PROVIDENCE ELECTRICAL
CONVENTION
DO NOT FAIL TO SEE THE EXHIBIT OF THE
PAISTE ELECTRICAL SPECIALTIES
AND GET
SOME PRACTICAL POINTERS
ON
Paiste Snap Switches,
Paiste China Switches,
Paiste Switch Sockets,
Paiste Pendant Cut-Outs.

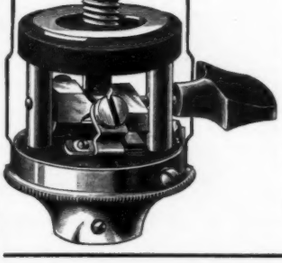
WHOEVER has old Storage Batteries, Zincs, Battery Copper, Scrap Copper Wire, old Hard Rubber, Etc., to sell, should write to
"METALS,"
CARE OF ELECTRICAL REVIEW, N. Y.

PATENT PERFORATED ELECTRIC LEATHER BELTING
MADE BY
Chas. A. Schieren & Co.,
New York, Chicago, Boston, Philadelphia.

72-Inch Double Belt (Second Order) for LOUISIANA ELECTRIC LIGHT CO., NEW ORLEANS, LA.
Two 48-Inch Double Belts for LOUISIANA ELECTRIC LIGHT CO., NEW ORLERNS, LA.
One 54-Inch Three-Ply Perforated Electric Belt for TACOMA RAILWAY & MOTOR CO., TACOMA, WASH.
One 41-Inch Three-Ply Electric Belt for CITIZENS' ELECTRIC ILLUMINATING CO., BROOKLYN, N. Y.
Two 30-Inch Three-Ply Perforated Electric Belts for GAUTIER STEEL DEPT., JOHNSTOWN, PA.

The Electrical Commissioners of the District of Columbia invite communications from firms interested in electric cables, conduits, subways, etc. Also upon the subject of municipal electric lighting, electric transmission of power, etc. Communications received until March 1, 1891. Personal interviews cannot be granted at present.
Address, ELECTRICAL COMMISSION,
Room 30, District Building, Washington, D. C.

"BRYANT SOCKETS."



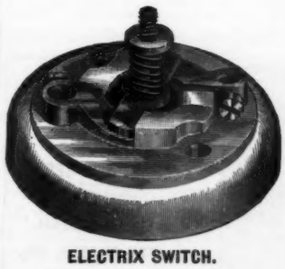
SEND FOR PRICES.

AGENTS:
A. B. C. Co., New York.
Vallee Bros. & Co., Philadelphia.
Geo. Cutter, Chicago.
Nat. Elec. Development Co., San Francisco.
Ball Elec. Light Co., Toronto Canada.

AN ATTRACTIVE EXHIBIT.

We extend a most cordial invitation to the members of the NATIONAL ELECTRIC LIGHT ASSOCIATION and their friends to carefully examine the STANDARD ELECTRICAL TEST INSTRUMENTS which we expect to place on exhibition at the PROVIDENCE MEETING.
Send for illustrated catalogue 1-66 of Electrical Test Instruments.

QUEEN & CO., PHILADELPHIA.


ELECTRIX SWITCH.

ELECTRIX SPECIALTIES.
Endorsed the World over by Users.
Simple. Reliable. Indestructible.
DEALERS REPORT QUICK SALES.
CORRESPONDENCE INVITED.
THE STAR ELECTRIX CO.,
1320 Wallace St., Philadelphia, Pa.

Address, for Circular of Styles and Prices,
JARVIS B. EDSON,
97 LIBERTY STREET. NEW YORK

Equitable Engineering & Construction Company.
ELECTRICAL ENGINEERS AND CONTRACTORS.
ELECTRIC RAILWAY AND POWER PLANTS.
Drexel Building, Philadelphia, Pa., U. S. A.
W. A. STADELMAN, MANAGER-CHIEF ENGINEER.

IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
Electric Light & Power Machinery,
196 SUMMER STREET, BOSTON.

THE
REMINGTON
has set the copy for writing machines for 15 years.
It is to-day the
STANDARD
and expects in the future, as it has in the past, to lead all others in adding improvements to what will always be the true model of a
TYPEWRITER
Wyckoff, Seamans & Benedict,
327 BROADWAY, NEW YORK.

Positively Headquarters!
AND
BOTTOM PRICES!!!
FOR
'SAMSON' BATTERIES
SEND YOUR CARD.
GET BOTTOM FIGURES!
FOR THE
MOST POWERFUL AND ENDURING OPEN-CIRCUIT BATTERY MADE.
A. L. BOGART,
Manufacturer of Electrical Supplies,
22 Union Square, N. Y. City.

# RAILWAY FEEDER-WIRES.

Experience has demonstrated the necessity for the ***Best Insulation*** on Feeder-Wires.

## THE BEST IS NOT TOO GOOD

—THE—

# SIMPLEX

—IS THE—

# BEST

**WITNESS THE FOLLOWING:**

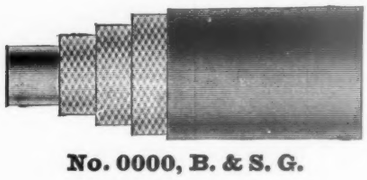
WEST END STREET RAILWAY CO.,
BOSTON, MASS., March 13, 1890.

SIMPLEX ELECTRICAL CO., Boston, Mass.:

*Gentlemen:* In regard to your inquiry concerning my opinio of the Simplex Wires, I would say that during the last year w have used a great many miles of the larger sizes, principally th **0000,** and it has given excellent satisfaction. There has been n case, to my knowledge, of trouble arising from these wires.

The general appearance and workmanship of the wire ar first-class, and I consider it equal to any wire, and superior to mos wires, for overhead work. Yours truly,

F. S. PEARSON,
*Chief Engineer Steam and Elect. Dept*



**No. 0000, B. & S. G.**

Send for Estimates to

## SIMPLEX ELECTRICAL CO.,

**620 ATLANTIC AVE.,**

**Boston, Mass.**

**A. C. POND, Prest., A. F. MASON, Gen. Mangr.**

EUGENE F. PHILLIPS, PRESIDENT. W. H. SAWYER, SEC. & ELECTRICIAN.

## AMERICAN ELECTRICAL WORKS,

Manufacturers of Patent Finished

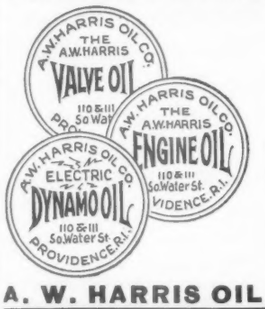
**ELECTRIC LIGHT WIRE,**

MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE,
RUBBER COVERED WIRE, LEAD ENCASED WIRE,
TELEPHONE & INCANDESCENT CORDS.

**FARADAY CABLES.**

Office and Factory, 67 STEWART STREET., PROVIDENCE, R. I.
New York Office, 10 Cortlandt St., P. C. Ackerman, Agt.

## THE SUPERIOR QUALITY OF THE HARRIS OILS




Has been fully established. Give them a trial and judge for yourself.

**VALVE OIL** for internal,
**ENGINE OIL** for external,
Lubrication of Steam Engines.
**DYNAMO OIL** for general Lubrication of Electric Dynamos.

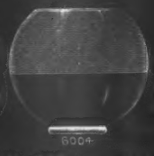
**A. W. HARRIS OIL CO., PROVIDENCE, R. I.**

## PHŒNIX GLASS CO

OF PITTSBURGH, PA.

MANUFACTURERS OF A FULL LINE OF

**ELECTRIC LIGHT**

**GLOBES**  **SHADES**

BOTH ARC AND INCANDESCENT.

RICH CUT, OPAL, CLEAR, ETCHED, ROUGHED, ETC.

ADAPTED TO ALL SYSTEMS.

729 BROADWAY, NEW YORK.
(COR. WAVERLY PLACE), AND
43 SIXTH AVE., PITTSBURGH, PA.

**F. Z. MAGUIRE,**

**ELECTRICAL SECURITIES, ETC.,**

**18 WALL STREET,**

**NEW YORK.**

*ELECTRIC AND STREET RAILWAY PROPERTIES BOUGHT AND SOLD.*

**THE PATENT FOR THE UNITED STATES**

for a glowing lamp which has been introduced to the public for years and is acknowledged to be of very favorable construction, is for sale on the most acceptable terms, or royalties may be sold. Please address offers to

Ho. 9932, care HAASENSTEIN & VOGLER, A. G., Berlin, S. W., 19, Germany.

**Norway Iron Frame**

**ELECTRIC BELL**

**IS THE**

**CHEAPEST AND BEST.**

Send for Illustrated Circular of Bells and

**Other Electrical Goods.**

**J. ELLIOTT SHAW & CO.,**

**632 ARCH ST., PHILA.**

**THE GREATEST**

**POROUS CUP BATTERY**

**IN THE WORLD.**

*SEND FOR CIRCULARS.*

**THE LECLANCHÉ BATTERY CO.,**

**NEW YORK.**

## AN EXCELLENT ARTICLE.

The P.&B. TRADE MARK REGISTERED INSULATING TAPE.

MANUFACTURED ONLY BY

THE STANDARD PAINT CO.,

RALPH L. SHAINWALD, Pres., 59 MAIDEN LANE, NEW YORK.

**SUPPLIES FOR ALL SYSTEMS.**

Prompt Shipments. Write for Prices.

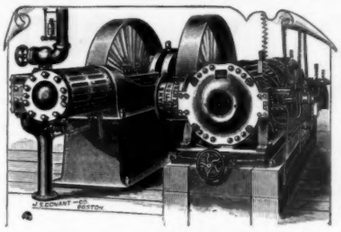
**W. H. CORDON & CO.,**

ELECTRIC LIGHT AND POWER SUPPLIES,

*SIMPLEX WIRES.* *115 Broadway, New York.*

## THE EVANS FRICTION CONE CO.,

**85 Water Street, Boston.**



Send for Catalogue D, for full particulars of the

EVANS SYSTEM

—OF—

DRIVING DYNAMOS.

Send for Catalogue C, for information in regard to the

**EVANS FRICTION CONES**

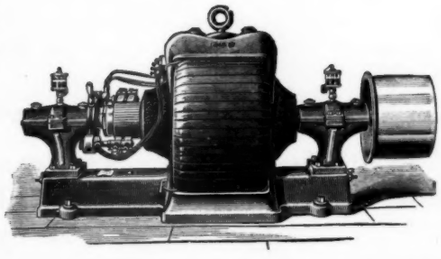
Evans Friction Cones.

## "C. & C." ELECTRIC MOTORS.

The only Motors in which the magnetic circuit forms a perfect circle around the centre of the armature shaft. Thus making the most compact and efficient form of machine that can possibly be devised.

One-eighth horse-power to 50 horse-power in stock.

OVER 10 000 MOTORS IN ACTUAL OPERATION.



**FAN OUTFITS.**

**Electric Blowers for Ship Ventilation.**

MOTORS FOR HOISTS AND MINING TRAMWAYS.

Equipment of Machine Shops, Printing Offices, Factories and Entire Buildings, with Electric Power.

New England Office, 63 Oliver Street, Boston.
Philadelphia " 38 South Fourth Street.
Chicago " Phenix Building.

## "C. & C." ELECTRIC MOTOR COMPANY,

**402 & 404 Greenwich Street, New York.**

## GRAPHITE PAINT.

**For Tin or Shingle Roofs and Iron Work. It is Absolutely without an Equal.**

A tin roof well painted will not need repainting for 10 to 15 years. If you need any paint, it will pay you to send for circular. **Joseph Dixon Crucible Co., Jersey City, N. J.**

All GENUINE INGOTS & MANUFACTURES BEAR OUR REG. TRADE MARKS

Phosphor Bronze

**PHOSPHOR-BRONZE**

INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

## THE American Bell Telephone Company,

**95 MILK ST., BOSTON, MASS.**

**This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.**

**The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.**

## THE Empire City Electric Co.

**15 and 17 DEY STREET,**

NEW YORK.

## Cut-Outs and Rosettes.

## Main Line and Branch Blocks.

***PRICES ON APPLICATION.***

# NEW AND VALUABLE BOOKS
ON
# ELECTRICITY AND ITS APPLICATIONS.

## ELECTRICITY AND MAGNETISM.

### Practical Electricity.
BY W. E. AYRTON.

A Laboratory and Lecture Course for first year of Students of Electrical Engineering, based on the Practical Definitions of the Electrical Units. **Numerous illustrations. Cloth. Price, $2.50.**

### The A. B. C. of Electricity.
BY W. H. MEADOWCROFT.

Giving, in simple language, a general outline of the Science of Electricity. ENDORSED BY THOMAS A. EDISON. **108 pages. Illustrated. Cloth. Price, 50c.**

### Elements of Magnetism and Electricity.
BY ANGELL.

With Practical Instructions for the Performance of Experiments and the Construction of Cheap Apparatus. **Numerous illustrations. Cloth. Price, 60c.**

### Electricity in Theory and Practice, or the Elements of Electrical Engineering.
BY LIEUT. BRADLEY A. FISKE, U. S. N.

Fifth Edition. **Cloth. 270 pages. 180 illustrations. Price, $2.50.**

## THE TELEPHONE.

### The Telephone.
BY PROF. A. E. DOLBEAR.

An Account of the Phenomena of Electricity, Magnetism and Sound, as involved in its action, with directions for making a Speaking Telephone. **Cloth. Illustrated. Price, 50c.**

### Practical Information for Telephonists.
BY THOS. D. LOCKWOOD.

Revised. New Edition. **192 pages. Cloth. Price, $1.00.**

### The Electric Telephone.
BY PROF. GEO. B. PRESCOTT.

Second Edition. Revised and Enlarged. Contains descriptions of new Telephone Inventions and Devices, and includes full descriptions of Hughes' Induction Balance and Sonometer, Boudet's Medical Microphone, Edison's Phonograph, Taintor's Graphophone, the Metropolitan Telephone Central Station, Simultaneous Telephone Transmission on the Same Wire, Installation of Telephone Offices, Construction of Telephone Lines, Aerial and Underground, The Electric Subways in New York, Long-Distance Telephone Lines, and Statistics of the American Bell Telephone Companies. **516 illustrations. 795 pages. Price, $6.00.**

## MISCELLANEOUS.

### Bell Hangers' Hand-Book.
BY F. B. BADT.

For those Engaged in selling, installing or handling Electric Batteries, Electric Bells, Elevator, House or Hotel Annunciators, Burglar or Fire Alarms, Electric Gas Lighting Apparatus, Electric Heat Regulating Apparatus, etc. **97 illustrations. Cloth. Price, $1.00.**

### Electric Bells and All About Them.
BY S. R. BOTTONE.

Giving full details as to the Construction of Batteries, Bells, Pushes, Detectors, etc., the Mode of Wiring, Testing, Connecting, Localizing Faults, in fact, directing careful attention to every case that can present itself to the Electric Bell Fitter. **100 illustrations. 196 pages. Cloth. Price, 50c.**

### Electro-Magnets.
BY COUNT DU MONCEL.

The Determination of the Elements of their Construction. **Boards. 122 pages. Price, 50c.**

### Electricity in Daily Life.
A Popular Account of the Science and Application of Electricity to every-day uses.

CONTENTS.—Electricity in the Service of Man; The Electric Motor; The Electric Railway; Lighting; The Telegraph; Cable-Laying; Electricity in Warfare—In the Household—Applied to the Human Body. **120 illustrations. Cloth. Price, $3.00**

### Short Lectures to Electrical Artisans.
BY J. A. FLEMING.

A Course of Experimental Lectures delivered to a Practical Audience. **74 illustrations. Cloth. Price, $1.50.**

### The Galvanometer and Its Uses.
BY C. H. HASKINS.

A Manual For Electricians and Students. Fourth Edition. Revised. **Morocco. Illustrated. Price, $1.50.**

### Dictionary of Electrical Words.
BY PROF. E. J. HOUSTON.

The words, terms and phrases are invariably followed by a short, concise definition, giving the sense in which they are correctly employed. **656 pages. 397 illustrations. Cloth. Price, $2.50.**

### Induction Coils.—How Made and How Used.
**Boards. Price, 50c.**

### Electrical Engineers' Pocket Book.
BY H. R. KEMP.

Modern Rules, Formulæ, Tables and Data. **Leather. Price, $1.75.**

### Electrical Measurement and The Galvanometer.
BY THOMAS D. LOCKWOOD.

Explaining its Construction and Use. **Cloth. Illustrated. Price, $1.50.**

### Lectures on The Electro-Magnet.
BY SILVANUS P. THOMPSON.

**Cloth. Price, $1.00.**

### Electric Light Fitting.
BY J. W. URQUHART.

A Hand-Book for Working Electrical Engineers, Embodying Practical Notes on Installation Management. **Numerous illustrations. Cloth. Price, $2.00.**

## POWER.

### Electric Motors.
BY S. R. BOTTONE.

A Hand-Book for Amateurs and Practical Men. **Illustrated. Cloth. 132 pages. Price, $1.20.**

### The Electric Motor and Its Applications.
BY T. C. MARTIN AND J. WETZLER.

New and Greatly Enlarged Edition. This timely work is the first American book on Electric Motors, and deals exclusively and fully with the modern Electric Motor in all its various practical applications. **300 pages. 275 illustrations. Price, $3.00.**

### The Electric Railway of To-day.
BY H. B. PRINDLE.

**Fully illustrated. Price, 50c.**

### The Electric Railway.
BY FRED H. WHIPPLE.

**259 pages. 117 illustrations. Price, $1.00.**

## ELECTRIC LIGHTING.

### Elements of Electric Lighting.
BY PHILLIP ATKINSON.

Including Electric Generation, Measurement, Storage and Distribution. Sixth Edition. **104 illustrations, 260 pages. Cloth. Price, $1.50.**

The most complete and comprehensive treatise on Electric Lighting ever published; giving the latest practical facts with the least amount of technicality and mathematical formulæ; with full treatment of the Dynamo, the Storage Battery and the principles of Direct and Alternate Current Lighting.

### Dynamo Tenders' Hand-Book.
BY F. B. BADT.

General rules for the care and operation of electric light installations in simple and plain language. Invaluable to dynamo tenders, linemen and others who wish to familiarize themselves with the principles underlying the care and operation of electric light installations. SEND FOR NEW EDITION WITH MOONLIGHT SCHEDULE FOR 1891. **Illustrated. Cloth. Price, $1.00.**

### Incandescent Wiring Hand-Book.
BY F. B. BADT.

Containing full instructions for Incandescent Wiring, and complete information concerning Methods of Running Wires, Location of Safety Devices and Switches, Splices, Insulation and Testing for Faults, Wire Gauges, General Electrical Data, Calculating Size of Wires, Wiring of Fixtures, Elevators, Buildings, Isolated and Central Station Plants. New Edition. **Illustrated. Cloth. Price, $1.00.**

### The Dynamo.—How Made and How Used.
BY S. R. BOTTONE.

A Book for Amateurs. Sixth Edition. **39 illustrations. 98 pages. Price, $1.00.**

### How to Make a Dynamo.
BY ALFRED CROFTS.

A Practical Book for Amateurs. Containing Numerous Illustrations and Detailed Instructions for constructing a small Dynamo. Third Edition. Revised and Enlarged. **Cloth. 104 pages. Price, 80c.**

### Incandescent Wiring Table
And other information for the use of Electric Light Wire Men. **Cloth. Price, 75c.**

### Incandescent Electric Lighting.
A Practical Description of the Edison System, to which is added a Description of the Edison Electrolytic Meter, and a paper on the Maximum Efficiency of Incandescent Lamps. **Boards. Price, 50c.**

### Alternate Current Machinery.
BY GISBERT KAPP.

**Illustrated. Boards. Price, 50c.**

### Practical Electrical Engineering.
A complete treatise on the construction and management of Electrical Apparatus as used in Electric Lighting and the Electric Transmission of Power. By men eminent in their respective departments. To be completed in 18 monthly parts. Sold only by subscription. **With many hundreds of illustrations. Each part, 75c.**

### Electric Light.—Its Production and Use.
BY J. W. URQUHART.

Fourth Edition. Rewritten with large additions. **Numerous illustrations. Cloth. Price, $3.00.**

### Practical Dynamo Building for Amateurs.
BY EDWARD WALKER.

How to Wind for any Output. **Numerous illustrations. Boards. Price, 50c.**

Copies of any of the above books, or any electrical work published, will be mailed to any address, postage prepaid, on receipt of price.
Remit by Express or Post Office Money Order, Postal Note, Draft or Registered Letter. Address

# ELECTRICAL REVIEW PUBLISHING COMPANY,
**P. O. Box 3329. 13 PARK ROW, NEW YORK.**

THE NATIONAL CARBON CO

CLEVELAND, OHIO.

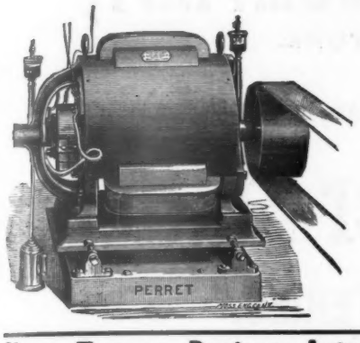
MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

THE ELEKTRON MFG. CO.,

79 and 81 WASHINGTON STREET, BROOKLYN, N. Y.,

MANUFACTURERS OF




Perret Electric Motors and Dynamos

LAMINATED FIELD MAGNETS, HIGH EFFICIENCY,
LOW SPEED, FULL POWER.

*Motors of any size for any purpose.* *Factories equipped throughout with Electric Power.*
*Isolated Plants for Incandescent Electric Lighting.*

SELLING AGENTS

BALTIMORE, MD., W. W. Donaldson, 215 N. Calvert St.
WASHINGTON, D. C., J. U. Burkett & Co., 1409 N. Y. Ave. ST. PAUL, MINN., F. J. Renz, 327 Minnesota St.
NEW ORLEANS, LA., George Baquie, 140 Gravier St. PHILADELPHIA, PA., Cleverly Electrical Works, 1018 Chestnut St.

New Tangye Buckeye Automatic Cut-off Engines.

In Use, Over 2,500.

25 to 1,000 H. P.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail.

Address BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS:

W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt Street, N. Y.
W. H. ROBINSON, 154 Washington St., Chicago, Ill. Robinson & Cary Company, St. Paul, Minn.

The Burton Electric Heater for Electric Railway Cars

NO SMOKE! NO GASES! EASILY MANAGED! ECONOMY IN SPACE!

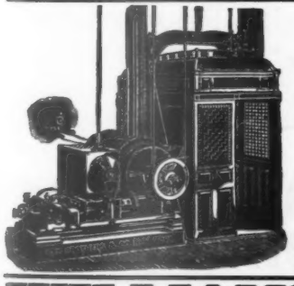
Normal use of current, THREE AMPERES, and the cost of this is in the coal burned at the generating station, which is actually LESS than that of coal burned in a stove on a car.

"They are giving us and the public entire satisfaction."—RICHMOND, VA., U. P. RY. CO.
"The heat is pleasant, sufficient and economical."—MARLBOROUGH, MASS., STREET RY. CO.
"We are much pleased with them, and know of no reason why we shall not continue to use them and recommend them to others."—ST. LOUIS AND EAST ST. LOUIS ELECTRIC RY. CO.

AGENCIES: Equitable Electric Ry. Construction Co., 416-420 Commercial Union Building, Phila., Pa.
Higgins Brothers & Co., 202 Main Street, Buffalo, N. Y.
Electric Merchandise Co., 11 Adams Street, Chicago, Ill.
St. Louis Car Co., St. Louis, Mo.

For Further Information, Address,

THE BURTON ELECTRIC COMPANY, RICHMOND VA.



OTIS

ELECTRIC ELEVATOR,

FOR

Stores, Office Buildings and Residences.

OTIS BROTHERS & CO.,

38 PARK ROW, NEW YORK.

WILLIAMS & POTTER,

15 CORTLANDT ST., NEW YORK.

Engineers & Contractors,

GENERAL AGENTS,

STRAIGHT LINE ENGINES

BARNES' PATENT UPRIGHT DRILLS.

20 to 42 inch swing, with both worm and self-feed and back-geared.

BARNES' Patent Engine Lathes

BARNES' Water Tool Grinder.

Emery

These machines have advantages not found in others of this line.

It will pay parties desiring to purchase to write us about them. Send for full description and prices to

W. F. AND JOHN BARNES CO.
419 Ruby St.,
Rockford, Illinois.

FIELD ENGINEERING COMPANY,

CONSULTING AND CONTRACTING ENGINEERS.

COMPLETE EQUIPMENT OF ELECTRIC STREET RAILWAYS,
DESIGNING AND CONSTRUCTION OF STATIONS, STEAM AND POWER PLANTS.

CORRESPONDENCE SOLICITED.

15 Cortlandt St., New York.

THE HEINE SAFETY BOILER CO.

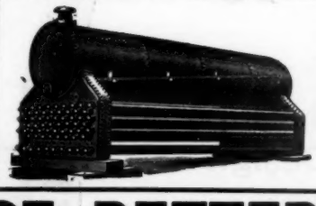
PATENT SAFETY WATER TUBE STEAM BOILERS.

NO CAST IRON PARTS. ALL PLATE STEEL.

*No contracted openings to drum, but full area of tubes carried out, thus assuring free circulation and dry steam. Adapted for all kinds of water and fuel. Manufactured both in the East and West. Send for Illustrated Catalogue.*

707 Bank of Commerce Building, St. Louis, Mo.,

—OR TO—



Heine Safety Boiler Co.....82 Madison St., Chicago, Ill.
Risdon Iron Works.....San Francisco, Cal.
Stearns, Roger & Co.....3 Duff Block, Denver, Col.
R. M. Huston.....Room 169, 45 Broadway, New York
Jos. K. Rugg & Co..107 West Second St., Cincinnati, O.
Van Zile, MacCormack & Co.....Albany, N. Y.
L. Metesser.....34 St. Charles St., New Orleans, La.
T. C. Gooch.....448 West Main Street, Louisville, Ky.
English, Morse & Co. 1221 Union Ave., Kansas City, Mo.
Seeger & Guernsey Co.....City of Mexico, Mexico.
Jas. H. Harris.....82 Madison Street, Chicago, Ills.

AGENTS.

JULIEN STORAGE BATTERIES

MANUFACTURED BY

The Consolidated Electric Storage Company,

Exclusive Licensee of the Brush and Julien Storage Battery Patents.

FOR AGENCIES AND LICENSES, ADDRESS THE COMPANY,

120 Broadway, N. Y.

FOR BATTERIES, ADDRESS THE COMPANY,

926 Drexel Building, Philadelphia, Pa.

## IRON CASTINGS FOR ELECTRICAL PURPOSES.

We cast Dynamo Magnets of a special mixture of iron that gives much better electrical results than ordinary castings. Also, small castings for Electrical Work, and castings, large and small, for all purposes, of finest quality. OUR PRICES ARE LOW. We run four large cupolas constantly, melting about 35 tons daily. Correspondence solicited.

**SESSIONS FOUNDRY CO., Bristol, Conn.**

---

# UNITED ELECTRIC TRACTION COMPANY,

**EXECUTIVE OFFICES, 115 BROADWAY, NEW YORK.**

AGENCIES:

926 Drexel Building, Philadelphia. 111 Water Street, Pittsburgh, Pa. 456 Rookery Building, Chicago.

# Electric Railways and Power Stations,

**STATIONARY MOTORS, STORAGE BATTERIES.**

**DYNAMOS, 1 to 250 H. P. MOTORS, ½ to 100 H. P.**

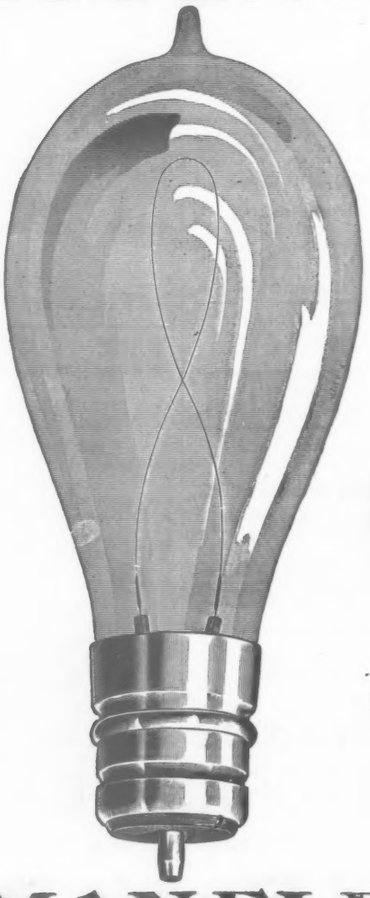
**WORKS, JERSEY CITY, N. J.**

---

# INCANDESCENT LAMPS

To Fit any Socket.

Excelling all others in Life, Maintenance of Candle-Power and Efficiency.



Even Diffusion of Light by Twisted Filament.

From 8 Candle-Power to 150 Candle-Power and any Voltage.

## THE BEST IS

General Electrical Supplies of Superior Design and Finish.

## THE CHEAPEST

Send for Our Catalogue of August 1st, 1890.

# SAWYER-MAN ELECTRIC CO.

620 Atlantic Avenue, BOSTON, MASS.

510-534 WEST 23d STREET, NEW YORK.

217 La Salle Street, CHICAGO, ILL.

# Electric Light Fitting.

## A Hand-book for Working Electrical Engineers,

EMBODYING PRACTICAL NOTES ON INSTALLATION MANAGEMENT.

By JOHN W. URQUHART.

Chapter I. Central Station Work.
Chapter II. Localizing Dynamo Faults, and Observations Respecting Accumulators.
Chapter III. Switchboard and Testing Work.
Chapter IV. Arc Light Wiring and Fitting.
Chapter V. Wiring for Incandescent Lamps.
Chapter VI. Incandescent Lighting of Ships.
Chapter VII. Miscellaneous Information.

226 PAGES, NUMEROUS ILLUSTRATIONS.

Price, $2.00.

SENT TO ANY ADDRESS ON RECEIPT OF PRICE.

ELECTRICAL REVIEW,
13 Park Row,
P. O. Box 3329. NEW YORK.

# "The Electric Railway of To-Day."

—BY—

## H. B. PRINDLE,

OF BOSTON.

## HANDSOMELY ILLUSTRATED.

THE SUBJECT POPULARLY TREATED.

An Able and Interesting and Timely Publication.

PRICE, 50 CENTS.

ADDRESS:

ELECTRICAL REVIEW,
13 Park Row, New York.

Porcelain Electrical Supplies and Specialties,
MANUFACTURED BY
EMPIRE CHINA WORKS,
144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.
Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL, and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES.

ELECTRICAL MEASUREMENT
Instruments and Batteries of the Very Highest Grade.
Precision and Constancy, Quality and Finish the Best in the World.
Catalogue of Standard Test Instruments furnished upon application.
THE E. S. GREELEY & CO.,
5 AND 7 DEY ST., NEW YORK.

W. R. OSTRANDER & CO.
195 & 197 FULTON ST., NEW YORK.
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS, Electric and Mechanical Bells.
FACTORY,
De Kalb Ave.,
BROOKLYN.
Send for Illustrated Catalogue.

Something New! One, two, three, and four spindle drills for light work.

DRILLS

The most useful patented improvement in drill presses for years is applied.

SENSITIVE

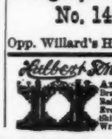
Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the latest and best. Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.
HARTFORD, CONN.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS,
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel. WASHINGTON, D. C.

Hulbert Bronze & Iron Co. St. Louis, Mo.
Artistic Metal Workers
Brass, Iron and Wire Office-work. Railings, Gratings, Moldings, etc. Everlasting Cemetery PENCILS. Shipped everywhere. Agents wanted. Write for Catalogue and Estimate.

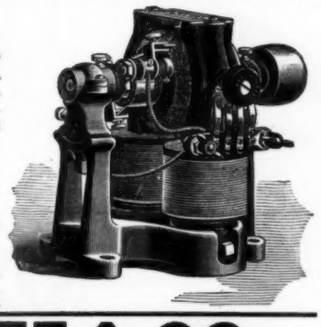


THE CROCKER-WHEELER
PERFECTED
MOTORS.

VERY SLOW SPEED—FULL POWER—PERFECT REGULATION—FORGED FIELDS, LET INTO BASE—SELF-OILING BEARINGS—SELF-CENTERING BEARINGS—ALL SIZES—BOTH ARC AND INCANDESCENT—FOR ALL POWER PURPOSES.

Acknowledged by the leading Manufacturing Companies to be
THE MOST PERFECT MOTOR MADE.

Estimates and Plans Furnished for Electric Power Equipment.
CORRESPONDENCE INVITED.
430-432 WEST 14TH STREET, NEW YORK.
S. B. WHEELER, President. F. B. CROCKER, Vice-Pres't.



BROWNLEE & CO.,
DETROIT, MICH.
CEDAR POLES
For Electric Purposes.
THE LARGEST STOCK AND QUICKEST SHIPMENTS.

☞ Manufacturers of the Celebrated Octagonal Red Pine Poles for Electric Railways and Electric Lighting; also Manufacturers of Cross-Arms and Pins.

THE TUBES OF THE
INTERIOR CONDUIT AND INSULATION COMPANY
ARE ESPECIALLY APPLICABLE TO
ELECTRIC RAILWAY REQUIREMENTS.
A Simple Solution of the Wiring Problem for Public Buildings, Residences, Factories, Station Work, Cars, Underground Feeders, and all places where insulation is required.
INTERIOR CONDUITS.
Endorsed by the Leading Electricians, Electric Light Companies, Wiring Contractors, Architects, Builders and Boards of Fire Underwriters.
UNDERGROUND CONDUITS
Are equally successful, and afford Cheapness, High Insulation and Durability.
*For Catalogue, Price List and General Information, address*
INTERIOR CONDUIT AND INSULATION COMPANY,
18 and 18 BROAD STREET, NEW YORK CITY. *EDWARD H. JOHNSON, Prest.*

# MOULDINGS

## FOR ELECTRICAL WORK, IN ALL KINDS OF WOOD.

Office and Storehouse: 150 and 552 West 38th Street NEW YORK.

## Independent Bung Co.

Large Stock Always on Hand.

Factories: Elizabeth, Wirt Co., W. Virginia, and NEW YORK.

# T. M. FOOTE REGULATOR CO.

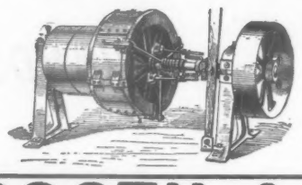
UNIFORM SPEED FOR

DYNAMOS,

STREET RAILROAD GENERATORS,

AND ALL CLASSES OF

MACHINERY.



Water Power Made Equal to Steam.

OFFICE:
271 FRANKLIN STREET, BOSTON, MASS.

WESTERN AGENTS:
CHANDLER & LITTLEFIELD, Marine Building, Chicago, Ill.

# HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

## BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

## PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the WASHINGTON CARBON CO.,

FACTORIES: WATERBURY, CONN.

NEW YORK OFFICE, 25 Park Place,

THOS. L. SCOVILL, NEW YORK AGENT

AGENTS FOR

OKONITE TRADE MARK

Wires, Tape and Cord, Candee Wire.

WHY BUY YOUR SUPPLIES OF THE

# SOUTHERN ELECTRICAL SUPPLY COMPANY,

823 LOCUST STREET, ST. LOUIS, MO.

Because their Stock is Complete. Shipments not Delayed. Prices not High.

*ELECTRIC LIGHT AND RAILWAY SUPPLIES A SPECIALTY. MOTORS AND DYNAMOS.*
*ALL KINDS OF PORCELAIN GOODS. KEY SOCKETS TO FIT ALL SYSTEMS.*

# NASSAU ELECTRICAL SPECIALTIES.

ACTUAL SIZE.

E. M. F., 1.07. Current, 2.30 amperes.

## CAPSULE BATTERY.

(Patented Aug. 19, 1890.)

SMALLEST EFFECTIVE BATTERY IN EXISTENCE.

PERFECTLY DRY.

Does not Require Wiring.

Never Polarizes.

Power Constant.

*Sample by mail, $1.10.*

## ELECTRICAL BELL OUTFIT.

(Patented Aug. 19, 1890.)

The Simplest and Most Complete Portable Bell Outfit in the market. The bell is operated by the Nassau Capsule Battery, concealed in the case of the push button.

This battery is not connected by wires and can by withdrawn and replaced by the user instantaneously when a renewal is necessary.

## Electric Alarm Thermometer.

(Patented Aug. 19, 1890.)

This thermometer sounds an alarm whenever the temperature rises above or falls below any required point.

**It is designed for use in Offices, Schools, Hospitals, Living Rooms, Baths, Breweries, Factories and all places where the maintenance of an equable temperature is desirable.**

It can be arranged to sound at any distance from the thermometer, and can thus be used as an infallible guard against fire.

## NASSAU ELECTRICAL CO., 19 Park Place, New York.

GOOD GOODS. PROMPT SHIPMENTS. LOW PRICES.

# GATE CITY ELECTRIC COMPANY,

Special Agents,

Manufacturers and Dealers in

Telegraph, Telephone, Electric Light

AND

GENERAL ELECTRICAL SUPPLIES.

OKONITE TRADE MARK

GLOBES AND SHADES,

Glass and Porcelain Insulators

AND

Incandescent Lamps.

AND CANDEE WIRES, CABLES, TAPE AND TUBING.

522 DELAWARE STREET, - - - - - - - - - KANSAS CITY, MO.

# The United States Electric Lighting Company,

**(WESTINGHOUSE ELECTRIC CO., Lessees.)**

## Arc and Incandescent Isolated Electric Light Plants.

AUTOMATIC DYNAMOS. PERFECT DEVICES.

**More than 1,000 Plants in Operation in Mills, Hotels, Office Buildings, Theatres, Etc.**

NEW U. S. MOTOR.

**ELECTRIC MOTORS AND GENERATORS.**

*Direct Current Generators and Motors for all purposes. 1-8 horse-power up to any power desired, and of any required E. M. F. Superior in Design and Workmanship, and Unequalled in Efficiency.*

SEND FOR NEW U. S. CATALOGUE ON INCANDESCENT LIGHTING AND MOTORS.

*General Offices: EQUITABLE BUILDING, 120 Broadway, New York.*

**TWO CENTS,**

**That's all it will cost you to write for prices.**

**WE CAN SAVE YOU MONEY.**

STANLEY & HALL,

**ELECTRICAL HOUSE FURNISHINGS,**

32 and 34 Frankfort Street, NEW YORK.

**HYDRAULIC PRESSES.**

ALL VARIETIES.

PUMPS, VALVES, GAUGES AND FITTINGS, PUNCHES, SHEARS, BUFFING MACHINERY, &c.

**WATSON & STILLMAN,**

210 East 43d Street, New York City.

Special Attention to Electrical Work.

THE LEHIGH VALLEY

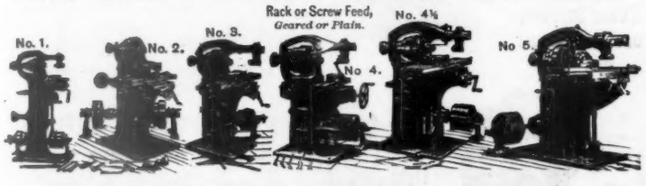
**CREOSOTING CO.**

WORKS, PERTH AMBOY, N. J.

Office, Foot of Washington Street, JERSEY CITY, N. J.

Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

**OUR LINE OF PLAIN MILLING MACHINES.**




**THE GARVIN MACHINE COMPANY,**

Manufacturers of, and Dealers in, all kinds of

**MACHINERY AND MACHINE TOOLS.**

*Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,*

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

Plants for Manufacturers of Sewing Machines & Electrical Goods.

GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] NEW YORK.

**T. C. WHEATON & CO.,**

FLINT GLASS MANUFACTURERS,

Millville, N. J.

INCANDESCENT BULBS, GLASS TUBING, Etc., Etc.

We make small Battery Jars and Insulators of different kinds for parties furnishing their own mould.

CORRESPONDENCE SOLICITED.

**ELECTRIC CONDENSERS**

WM. MARSHALL, MANUFACTURER.

Standards a Specialty.

Rooms 2 and 4, University Building, New York.

**VENTILATING FANS OF EVERY DESCRIPTION.**

**D. H. KULP,**

LANCASTER, Pa.

Box 345.

Patterns, Models, Drawings, Etc.

**Sigourney Drills.**

**IMPROVED.**

Sensitive, Strong and Interchangeable. One, Two and Three Spindles.

GUARANTEED PERFECT.

Send for Price List "B."

**The Sigourney Tool Co.,**

HARTFORD CONN.

**SUBSCRIBE FOR THE ELECTRICAL REVIEW. NOW**

# ARC LAMPS FOR INCANDESCENT CIRCUITS.

**THE UNIVERSAL ARC LAMPS.** These lamps are intended for direct current circuits, giving a steady and noiseless light, and can be adjusted for circuits having a pressure from 100 to 125 volts, using from eight to nine amperes; when burning two in series, the resistance is coiled about the chimney at the top of each lamp, within which the carbon rod is suspended, thereby rendering any additional resistance unnecessary.

Electric light stations and owners of isolated plants using low potential currents will do well to examine this lamp before purchasing elsewhere, as our claim for the lamp is that it is the best article in the market.

**THE UNIVERSAL THEATRICAL ARC LAMP.** This lamp is manufactured for stage uses, taking the place of the calcium lights, and can be used wherever constant direct circuits exist; it can be easily handled and has all the effects of the calcium, and the cost of running same being very much cheaper than the old-fashioned method. We are prepared to furnish complete outfits at shortest notice; prices and references on application.

FOR PRICES AND FURTHER INFORMATION, APPLY TO

## THE UNIVERSAL ARC LAMP CO.,

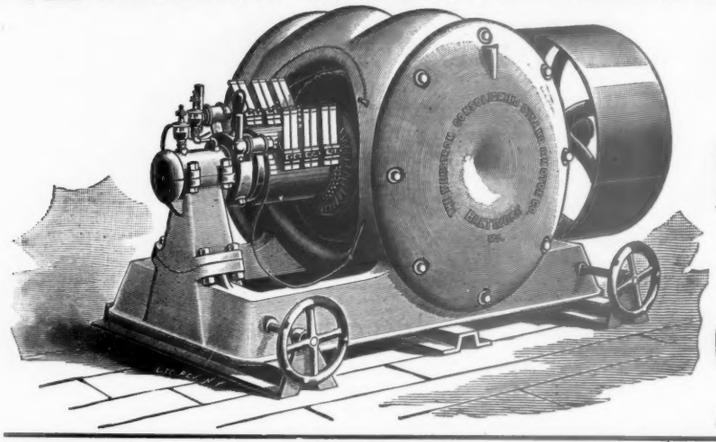
Executive Office: 16 AND 18 BROAD STREET. Salesrooms: 49 WEST 22d STREET.

J. H. McCLEMENT, President. NEW YORK. E. S. MENDELS, General Manager.

OR TO

THE ELECTRICAL SUPPLY CO., Chicago, Ill. ST. LOUIS ELECTRICAL SUPPLY CO., St. Louis, Mo. SOUTHERN ELECTRICAL MFG. & SUPPLY CO., Limited, New Orleans, La. WALKER & KEPLER, Philadelphia, Pa. PETTINGELL-ANDREWS CO., Boston, Mass.

# THE WENSTROM CONSOLIDATED DYNAMO AND MOTOR CO., OF BALTIMORE, MD.,



MANUFACTURERS OF

## ELECTRICAL APPARATUS,

ELECTRIC MOTORS FOR ALL WORK,

Dynamos for Incandescent Lighting.

SPECIAL FEATURES:

High Efficiency. ✳ Slow Speed.

For full information and circulars address,

## CHADBOURNE, HAZELTON & CO.,

SOLE SELLING AGENTS FOR U. S.,

416-420 WALNUT ST., PHILADELPHIA.

AGENTS WANTED IN ALL LEADING CITIES.

Daniel W. Baker. Cyrus O. Baker, Jr.

## BAKER & CO.,

Importers, Melters and Refiners of

# PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

BUY THE

# SCHUYLER APPARATUS

IF YOU WANT THE BEST

## Arc Lighting System.

## Office and Factory:

## MIDDLETOWN,

CONN.

# EUREKA TEMPERED COPPER COMPANY,

NORTH EAST, PA.,

ONLY MANUFACTURERS OF PURE COPPER TEMPERED FOR

Brush Copper, Commutator Bars, Copper Wire, Gear Pinions, Bearings, Trolley Wheels.

WESTERN SALES OFFICE: 225 DEARBORN STREET, CHICAGO.

EASTERN SALES OFFICE: 35 BROADWAY, NEW YORK.

## The McCREARY ELECTRICAL SPECIALTY CO.

ELECTRICAL SPECIALTIES.

SEND FOR ILLUSTRATED CATALOGUE.

18 & 20 CORTLANDT STREET, NEW YORK.

FOR Electric Light and Power Supplies, SEE CATALOGUE No. 560.

THE ELECTRICAL SUPPLY CO. CHICAGO.

FOR Bells, Batteries, Annunciators, District Telegraph Supplies, etc. SEE CATALOGUE No. 648.

Best Light — SUNBEAM INCANDESCENT LAMPS — For Least Money

HABIRSHAW CABLES AND CORES.

*Samples Forwarded without Charge.*

STATE VOLTAGE AND STYLE OF SOCKET.

For Feeder Wires. For Overhead Electric Light Circuits.

Combines Greatest Conductivity — WITH — Great Tensile Strength.

Should be used wherever a high grade of insulation is necessary.

FOR CONCEALED WIRING. FOR DYNAMO CABLES.
FOR SWITCHBOARD CABLES. FOR UNDERWATER WORK.

BUY THE BEST.

# FARADAY CARBON CO.,

## ELECTRIC LIGHT CARBONS, PITTSBURGH. PA.

## Washburn & Moen Mfg. Co.,

WORCESTER, MASS.

MAKERS OF

IRON AND STEEL

MANUFACTURERS OF

Iron and Copper Wire for Electrical Purposes.

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

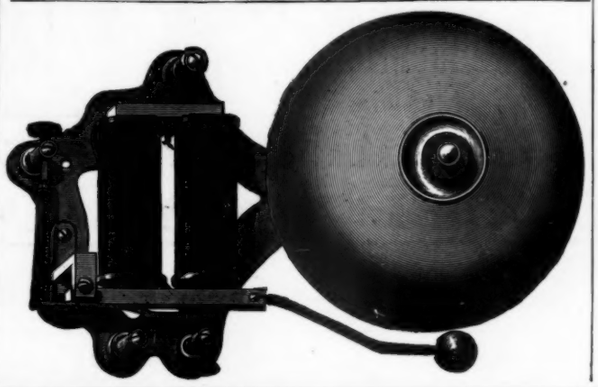
Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse. 16 CLIFF STREET.

Chicago Warehouse, 107 & 109 LAKE ST.

## Manufacturers



H. E. & C. BAXTER, 18 Fulton Street, Brooklyn, N. Y.

## GENUINE TELEPHONES FOR EXPORT.

## THE TROPICAL AMERICAN TELEPHONE CO.,

Sole Authorized Exporters to South America, Central America and West Indies.

AMERICAN BELL TELEPHONES, BLAKE TRANSMITTERS AND MAGNETOS.

OLD SWITCHBOARDS AND MAGNETO CALL BELLS FOR SALE CHEAP AND TAKEN IN EXCHANGE FOR NEW ONES.

This Company having ascertained that certain parties in New York have, through misrepresentation and deceit, obtained from our New York Agent Telephones, Transmitters and Magneto Call Bells, sold for export only, on written orders stating a foreign destination, and then instead of so exporting them, as agreed in the order and bill of sale, keeping them in the United States for unauthorized purposes and use, this is to certify that this Company will sell no more of its export telephonic instruments to Messrs. J. F. Denton & Co. or Mr. B. Blum, and disapproves and condemns such action, and will continue to exact the true destination and agreement to export all telephonic instruments sold by it, as has been its uniform custom heretofore.

Address all orders to

THE TROPICAL AMERICAN TELEPHONE COMPANY, Limited,

18 CORTLANDT STREET, NEW YORK CITY, or 95 MILK STREET, BOSTON.

SUNLIGHT CARBONS

THE PARKER-RUSSELL MINING & MFG. CO.

MERMOD-JACCARD BUILDING,

Cor. Broadway and Locust St. Rooms 307 and 308.

ST. LOUIS.

UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE LEFFEL WATER WHEEL

SEND FOR CATALOGUE.

JAMES LEFFEL & CO. SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

"Prices are low yet quality tells."

A Corliss Engine

well designed and thoroughly built, is the best the world today possesses.

The Lane & Bodley Co., Cincinnati, O., have a high ideal of what their engines should be, and invite their customers to say what they are. If you want an engine and never have seen one of these, write for descriptive circular.

THE LANE & BODLEY CO., CINCINNATI, O.

NEW YORK BELTING AND PACKING CO.

LARGEST BELTS IN THE WORLD.

RUBBER BELTING, PACKING, HOSE,— —MATS, MATTING, STAIR-TREADS.

15 PARK ROW, NEW YORK.

(OPPOSITE ASTOR HOUSE.)

J. H. CHEEVER, TREAS. J. D. CHEEVER, DEP'Y. TREAS.

## W. E. WEATHER-PROOF WIRE.

*We quote from a letter received from a well-known expert regarding recent tests of the leading weather-proof wires now on the market:*

*We have tested the samples of wire handed us, and make the following report, the size of the wire, length of pieces and the immersion, being exactly the same in all particulars:*

RESISTANCE OF INSULATION.

| Sample. | On Immersion. | After 24 Hours. | 48 Hours. | 96 Hours. | 144 Hours. |
|---|---|---|---|---|---|
| No. 1, | 28,000 megohms, | 130,000 ohms, | 80,000 ohms, | 27,586 ohms, | 25,000 ohms. |
| " 2, | 93 " | 960,000 " | 320,000 " | 10,000 " | 1,363 " |
| " 3, | 7 " | 900,000 " | 800,000 " | 500,000 " | 272,727 " |
| " 4, | .46 " | 65,000 " | 2,856 " | 1,600 " | 1,000 " |
| " 5, | 3.5 " | 83,000 " | 0 " | 0 " | 0 " |
| " 6, | 2.8 " | 7,000 " | 4,000 " | 1,666 " | 1,071 " |

Sample No. 3 is our improved weather-proof wire, and we guarantee it the equal, if not the superior, of any other wire of like character. PRICES ON APPLICATION.

WESTERN ELECTRIC COMPANY, CHICAGO---NEW YORK.

# FORT WAYNE ELECTRIC COMPANY,

## FORT WAYNE, IND.

MANUFACTURERS OF THE

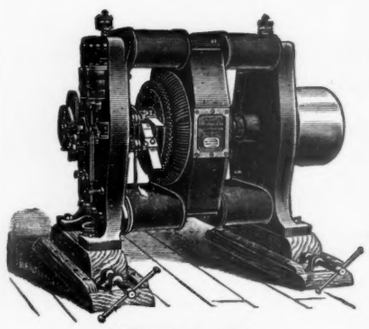
## Slattery Induction System of Long Distance Incandescent Lighting

AND THE

Wood Automatically Regulating

## ARC DYNAMO AND LAMPS.

**Main Office, FORT WAYNE, IND.**



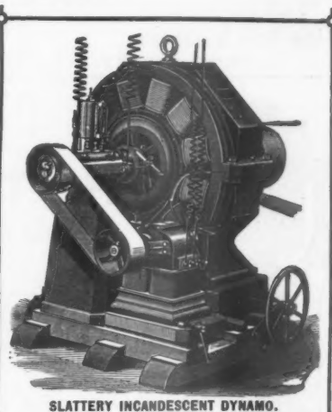
WOOD DYNAMO.

BRANCH OFFICES:

| | |
|---|---|
| NEW YORK, - | 115 Broadway. |
| PHILADELPHIA, | 907 Filbert Street. |
| PITTSBURGH, PA., | 533 Wood Street. |
| CHICAGO, - - | 185 Dearborn Street. |
| SAN FRANCISCO. | 35 New Montgomery Street. |
| BUFFALO, - - | 228 Pearl Street. |
| TORONTO, CANADA, | 138 King Street. |
| MEXICO, F. Adams' Successors, City of Mexico. | |

FACTORIES:

| | |
|---|---|
| FORT WAYNE, - - - - - | INDIANA. |
| BROOKLYN, - - - - - | NEW YORK. |



SLATTERY INCANDESCENT DYNAMO.

## ELECTRICAL ACCUMULATORS.

**Useful and Economical for all Purposes to which Electricity is Applicable, such as Propulsion and Lighting of Street Cars, Vehicles, Yachts, Etc.**

Central Station and Isolated Lighting,
Portable Lighting or Power,
Portable Electric Lanterns,
Electric Power for Motors,
Portable Electric Fans for Office, Family and Sick Room.

Only Clean and Convenient Battery for Surgeons, Dentists and Professional Men generally.

**Manufactured Exclusively under the Patents of**
**FAURE, SWAN, SELLON, GRISCOM and others.**

COMPLETE ELECTRIC LIGHT & POWER PLANTS.

## THE ACCUMULATOR COMPANY,

**44 BROADWAY, NEW YORK.**

PHILADELPHIA AGENCY:
ELECTRO DYNAMIC COMPANY, 224 Carter Street, Philadelphia, Pa.
CHICAGO AGENCY: 239 La Salle St. SAN FRANCISCO AGENCY: 220 Sutter St.
BOSTON AGENCY: HOLTZER-CABOT ELECTRIC COMPANY, 111 Arch St.
PROVIDENCE AGENCY: SWARTS & GANNETT, Swarts Building.

## The "Standard" Instruments for Electric Testing.

VOLTMETERS AND AMMETERS FOR
CENTRAL STATION, LABORATORY & BATTERY WORK.

WE GUARANTEE OUR INSTRUMENTS CORRECT, AS EACH INSTRUMENT IS CAREFULLY CALIBRATED BEFORE LEAVING THE LABORATORY, AND WE FURTHER GUARANTEE TO KEEP THEM IN CALIBRATION IF SENT TO US FOR THAT PURPOSE.

*TO SUM IT UP.*

OUR "STANDARD" VOLTMETERS AND AMMETERS FILL THE LONG FELT WANT FOR A LINE OF INSTRUMENTS COMBINING ACCURACY, BEAUTY AND, MORE ESPECIALLY, REASONABLENESS IN PRICE.

WE SOLICIT YOUR CORRESPONDENCE.

A SPECIAL LINE OF VOLTMETERS FOR RAILWAY WORK AT LOW FIGURES.

PRICES QUOTED ON APPLICATION.

## STANDARD ELECTRIC SUPPLY CO.,

180 SUMMER STREET, BOSTON, MASS., SOLE AGENTS.